

## SYMPOSIUM ON ENVIRONMENTAL HEALTH SCIENCES

Friday, April 30, 1993

1:30 P.M.

Wick-Pollock Inn Butler 1

Cynthia F. Bearer, Presiding

**ANALYSIS OF FORMALDEHYDE IN DIALYSIS SOLUTIONS USING 4-AMINO-5-HYDRAZINO-4H-1,2,3-TRIAZOLE-3-THIOL.** J.H. Mike and M.J. Patrick, Dept. of Chemistry, Youngstown State University, Youngstown, OH 44555.

A common method for disinfecting the apparatus used for kidney dialysis is to rinse with formaldehyde solutions. A problem associated with this process is that formaldehyde adsorbs to the surfaces of the dialyzers and tubing and, even after thorough rinsing, still dissociates 51 slowly into the dialysis solutions. Formaldehyde is thus introduced into the patient's body via the dialysis process. A commonly used method for detection of formaldehyde for monitoring the disinfection process relies upon Clinitest x tablets. These tablets, however, will detect only relatively large amounts of formaldehyde, with detection limits of around 0.01 mg/dL. 4-Amino-5-hydrazino-4H-1,2,3-triazole-3-thiol (Purpald™) has been used to detect aldehydes, including formaldehyde, by formation of a purple-colored adduct. We have applied this reagent to detection of formaldehyde in dialysis rinse solutions. The purple color was found to increase linearly with concentration, and detection limits (S/N = 2) using a simple spectrophotometer were determined to be 0.0024 mg/dL. Results for levels of formaldehyde will be reported for samples of dialysis solutions obtained from machines before and after rinsing with water.

**LEAD EXPOSURE IN A PRENATAL POPULATION.** M.A. Stefanak, Mahoning County Health Dept., Youngstown, OH 44507.

The fetus is particularly sensitive to the neurotoxic effects of lead. Currently, prevention of lead exposure to the mother is the only effective, safe method of prevention for the fetus. To estimate the prevalence of exposure, we screened a population of prenatal clinic patients. Prevalence of blood lead elevation 10 mcg/dl or greater in these patients is approximately 11%. Several environmental risk factors have emerged as predictors of maternal blood lead elevation. A significant relationship between elevated blood lead and residence in pre-1950 housing was observed. Dust lead levels in these homes were, on the average, 1,136 mcg/ft<sup>2</sup> higher than levels in the homes of controls without blood lead elevations. These homes underwent lead dust control and, subsequently, were monitored for control efficacy, mean dust lead levels of 3,299 mcg/ft<sup>2</sup> were reduced to 125 mcg/ft<sup>2</sup> after dust control. In the homes for which six month post-cleanup levels are available, dust lead remains below target levels on all but a few surfaces tested. These results show that lead dust control is an effective means to reduce environmental lead, thus leading to reduced prenatal exposure.

**CONGENITAL NEUROTOXICITY OF POLYCHLOROBIPHENYLS (PCBs)** J.K. Krontiris-Litowitz, Dept. of Biological Sciences, Youngstown State University, Youngstown, OH 44555.

PCBs are a family of compounds that have been used in industrial settings as lubricants, heat transfer solvents, and dielectric fluids. These agents are chemically stable, resist degradation, and accumulate in air, soil, water and ultimately the food chain. Hence they are a persistent and significant concern to the communities that surround industrial sites. One sector of the population that is particularly sensitive to PCBs is infants and young children. Maternal PCB exposure during gestation and nursing is associated with developmental delays, atypical motor activity, impaired learning, and poor memory performance of offspring. One question that arises is how prenatal PCB exposure can cause learning and memory deficits. This can be addressed in young prenatally exposed rats using long-term potentiation (LTP) of the hippocampal slice as a cellular model of learning and memory. PCB-induced changes in LTP in rats may provide an insight into the mechanism of PCB-induced learning deficits in children.

**PEDIATRIC ENVIRONMENTAL HEALTH TRAINING: IMPACT ON PEDIATRIC RESIDENTS.** C.F. Bearer and R. Phillips, Dept. of Chemistry, Youngstown State University, Youngstown, OH 44555.

A curriculum of pediatric environmental health was incorporated into a pediatric residency program. To investigate the efficacy of the course, residents' behavior was examined before and after presentation of the curriculum. The initial history and physical assessments were examined for all cases of status asthmaticus admitted to Children's Hospital Oakland in June of 1990 and 1991. The two groups were comparable by year of training of resident, time of day of admission, number of first admissions, and repeat admissions within a year. Chi square analysis revealed a significant difference in the number of environmental questions asked in the group trained in

pediatric environmental health compared to the group which received no instruction. We conclude that the incorporation of the curriculum in pediatric environmental health markedly affected pediatric residents' behavior in assessing environmental etiologies for common illnesses.

### DISCUSSION

## SYMPOSIUM ON THE CHANGING FACE OF ENGINEERING

Saturday, May 1, 1993

9:30 A.M.

Cushwa Hall 1062

R. Lynn Gilliland, Presiding

**THE CHANGING FACE OF ENGINEERING.** R. Lynn Gilliland, GM Powertrain Division, 1711 Crestwood Dr., Defiance, OH 43512.

The engineering needs of the industrial community have changed drastically in recent years. The downsizing of major industries has necessitated development of new talents in the current work force, and has redefined the qualifications required of new graduates. One specific item is the need for a background in statistical problem solving methods and applications. Three more generalized areas are (1) Group working relationship skills, (2) Group leadership, and (3) Diversity of disciplines. The "old" engineer became an expert in his field of expertise, and spent a lifetime at it. The "new" engineer, however, is not hired for his or her technical skills as much as his relationship skills and leadership skills. Engineers must have the ability to apply the basic engineering and scientific principles to a multi-varied array of disciplines, and understand mathematical and statistical analyses of problems. The Academic community must be aware of this shifting role of engineers.

**DISCUSSION BY:** Mr. Bob Koval, Engineering Manager, GM Packard Division, Warren, OH and Dr. Lester Smith, College of Engineering, Youngstown State University.

## TECHNICAL SESSIONS

### LIBRARY SCIENCE

1:30 P.M., Friday, April 30, 1993

Main Library 5th Floor

Rajinda Garcha, Presiding

1:30 **MAJOR ISSUES IN PRISON LIBRARIANSHIP.** Peter C. Kozup, 5115 North Park Ave., Warren, OH 44481.

In this study, three prison librarians are interviewed on the ways they handle major issues in their libraries. A case study approach is used to examine the ways these librarians deal with those issues. The issues examined include materials selection and acquisition, including the matter of censorship of materials; the use of inmate staff in the libraries, including their selection, training, and evaluation; and the provision of library service to inmates, including inmate access to the library, library-based programs for inmates, and the provision of outreach services to inmates who are unable to go to the library. The study concludes that the librarians vary in the way they handle these matters, and that many things influence them—especially the impact of the prison administration and staff, but also such things as the physical space available for the library, civilian staffing available, the type and number of prisoners in the institution, and even the personality of the librarian.

1:45 **COST CONTAINMENT AND THE UNIVERSITY SCIENCE CURRICULUM.** Barbara A. Ford-Foster, Ogg Science and Health Library, Bowling Green State University, Bowling Green, OH 43403.

At Bowling Green State University, Science faculty notify their subject librarians and work collaboratively with them when they have an idea for a new course, or when a course is being drastically modified. A conference with the subject librarian at inception of the idea means that both time and money can be saved. There is often overlap in disciplines, and faculty members

aren't always cognizant of what effect colleagues' requests may have on their collection development needs. Forms advising subject librarians of new courses and/or curriculum modification initiate an analysis of specific LC classes and the use of available material. These forms create an opportunity for collection evaluation and analysis of what currently exists to support teaching and research needs. Faculty are then advised of costs, based on knowledge of the new tools and materials needed for additional modification. At BGSU, this curriculum modification process utilizes AMIGOS, Books-In-Print, and in-house systems to inform the University Curriculum Committee, Dean of Library and Learning Resources, and subject librarians of costs that are vital budget data. This process assists faculty when a site visit for accreditation is approaching. What makes this particular process adaptable and desirable at BGSU is its provision to inform and include all faculty before final fund allocation decisions are made.

2:00 MAINTAINING RECORDS FOR PERIODICALS AND SERIALS IN AUTOMATED DATABASES. Dale Ebersole, Jr., Carlson Library, University of Toledo, Toledo, OH 43606.

Both periodical (arrive at a predicted interval of at least two issues per year) and serial title (all others) records are maintained in two automated systems - NOTIS and Innovaq. Holdings for all periodicals and serial standing orders are on both systems. An automated solution for updating records on the second system (NOTIS) is being sought. For new or changed titles, the associated serial bibliographic records are down-loaded from OCLC. Appropriate check in (III) or holdings records (NOTIS) are created. For records on both systems, the appropriate identification number for the other system is attached. Finally, labels are produced and attached. For periodicals, this is accomplished in the Serials Department. The other items are forwarded to Processing for labeling and barcodes.

2:15 ACCESSING INFORMATION IN AN EXPANDING ENVIRONMENTAL MARKET. Edward Weiliant, Science Library, 318 Math Science Building, Bowling Green State University, Bowling Green, OH 43403.

The environment has emerged as an area of worldwide concern. Environmental problems are the common problems of the entire planet. The environmental crisis which now exists requires that those individuals involved in the environmental decision-making process have rapid access to all available relevant information. As new information products and information delivery services develop, enabling faster access to the growing body of environmental information, librarians may find it increasingly difficult to determine where they should direct their patrons. Resources which assist the librarian in dealing with this problem are examined.

2:30 CHEMICAL ABSTRACTS ON CD-ROM. Ann D. Bolek, Science-Technology Library, The University of Akron, Akron, OH 44325-3907.

The 12th Collective Index (1987-1991) of Chemical Abstracts is being offered on CD-ROM and should be available in early 1993. Searching the CD-ROM version will be similar to searching the paper version without some of the annoyances. For example, the elimination of "see" references. In addition, the registry numbers of chemical substances will be searchable; however, the CD-ROM version will be quite different from the on-line version. The experiences in using the CD-ROM version will be shared.

2:45 LIBRARY KNOWLEDGE OF THE INTERNATIONAL STUDENTS AT THE AMERICAN LANGUAGE INSTITUTE OF THE UNIVERSITY OF TOLEDO: A RESEARCH IN PROGRESS REPORT. Rajinder Garcha and Patricia Yates-Russell, Carlson Library, University of Toledo, Toledo, OH 43606.

A survey was administered to 63 international students in The American Language Institute's intensive English program at the University of Toledo. These students from 18 countries represent the upper levels of the enrollment of the ALI. Of that number, ALI students are intending to enter undergraduate degree programs and 22 are planning to pursue graduate degrees. The main object of the survey was two-fold: One was to find out what their background knowledge of academic libraries is; and second, to facilitate a program to meet the special needs of these multicultural groups. The survey was divided into three sections: Demographic data regarding the students, their previous library use experience, and awareness of the use of the University of Toledo's Carlson Library. The survey was conducted after the students were given a two-hour library orientation by individual staff members. A survey of the literature indicated that very little research on the library orientation of these types of multicultural groups has been done. Therefore, it is the intention of these researchers to analyze the data of this survey and recommend necessary changes in the orientation of the library use for such a diverse cultural population at academic institutions.

3:00 DIGITAL DATA AND THE CHANGING MAP COLLECTION. Edward J. Hall, Map Librarian, Kent State University Libraries, Map Library, 410 McGilvrey Hall, Kent State University, Kent, OH 44242-0001.

A number of Federal and State agencies have begun to issue cartographic products in digital

formats. Digital data is useful for the production of cartographic base maps which may be combined with other digital cartographic/geographic data to help scientists to conduct geographic and geologic analyses. The United States Geological Survey announced last year that it was beginning to issue its 1:100,000 United States 30 x 60 minute series in the format of line map information in digital form (DLG). This innovation represents a major change in the handling of map information in libraries. USGS distributes these digital cartographic/geographic data files as a part of the National Mapping Program. These data files come in three basic map forms: The first of these is the digital elevation model (DEM) consisting of a sample of elevations for a number of regularly spaced ground positions; the second type provides information on the nine major classes of land use—urban, forest, and agricultural, and associated map data such as political units and Federal land ownership. These are called Land Use and Land Cover digital data; the third file, the subject of this paper, is line information in digital form and is called the "Digital Line Graph" (DLG). Some map librarians are beginning to provide this data to users as well as the conventional "paper map".

## POSTER SESSION

10:00 A.M., Saturday, May 1, 1993

### Cushwa Hall Lobby

Board A GLOBAL CLIMATE CHANGE AND ELM LEAF BEETLE PERFORMANCE ON 'HOMESTEAD' ELM. J. H. Barger, W. N. Cannon, Jr., USDA Forest Svc., 359 Main Rd., Delaware, OH 43015; and R. W. Hall, Dept. of Entomology, The Ohio State University, Columbus, OH 43210.

Reliable techniques using insects need to be developed that can measure early plant stress and subtle climate change due to atmospheric pollutants and "greenhouse" gases. Six-year old potted elm trees were fumigated with ambient air and combinations of elevated levels of CO<sub>2</sub> and O<sub>3</sub> in open-top chambers. Tree diameter growth, leaf water and nitrogen content, and elm leaf beetle (ELB) fecundity, leaf area consumed, feeding preference, and mortality data were collected. There were significant decreases in water and nitrogen content of leaves and significant increases in diameter growth and leaf weight for trees fumigated with both elevated CO<sub>2</sub> and CO<sub>2</sub> + O<sub>3</sub>. ELB fecundity and leaf area consumed decreased significantly on leaves fumigated with both elevated CO<sub>2</sub> and CO<sub>2</sub> + O<sub>3</sub>. ELB mortality was unaffected. Results may provide additional information for national environmental policy decisions and for statistical models to predict the consequences of global climate changes on forest health and productivity.

Board B THE SOIL SEED BANK OF HUFFMAN PRAIRIE. Scott J. Meiners and David L. Gorchov, Dept. of Botany, Miami University, Oxford, OH 45056.

The soil seed bank of Huffman Prairie at the Wright-Patterson Air Force Base, Dayton, Ohio was investigated to determine seedling density and composition of dicot species. Soil samples 10 cm deep and 7.62 cm in diameter were collected 29 January 1992 from three distinct areas: Swale (n=10), weedy (n=10), and prairie (n=12). The samples were sifted and placed in greenhouse flats over 3 cm of sterile soil. Germination was monitored weekly for 90 days. Prairie and weedy samples yielded similar total seedling densities (5,902 and 5,109 m<sup>-2</sup>), while the swale had 15,262 seedlings m<sup>-2</sup>. Dicots comprised 81.7% of the seedlings. The samples contained 15 introduced and 17 native dicots, of which six were common to pre-settlement prairies. Swale samples contained fewer prairie species than the other areas. Of the dicot seedlings that survived to be identified, 60% were native species. Three species common in pre-settlement prairies that were present in <= 1% of plots of above ground vegetation: *Eupatorium altissimum*, *Liatris spicata*, and *Oenothera biennis* were present in >= 6% of the seed bank samples. This indicates that the frequency of these species could be enhanced by manipulation to promote germination.

Board C SURVEY OF THE NITIDULIDAE IN TWO NON-AGRICULTURAL SITES IN WAYNE COUNTY. R. N. Williams, M. S. Ellis, J. Griffiths, S. Schnipke, and L. E. Ringley, Jr., Dept. of Entomology, Ohio Agricultural Research and Development Center of The Ohio State University, Wooster, OH 44691.

In an effort to determine the nitidulid species occurring throughout the State of Ohio, two sites in Wayne County were surveyed through trapping with several baits used in NIT (ground and aerial) and PVC pipe traps. The Overton site is located just above water level (880 ft. above sea level); whereas, the Moreland site was in an upland woodlot (960 ft. above sea level). Both sites are generally deciduous wooded lots—not too distant from agricultural areas. The Moreland site yielded at least 26 species. Of these, *Glischrochilus quadrisignatus*, *G. fasciatus*, *G. sanguinolentus*, *Carpophilus lugubris*, *C. hemipterus*, and *Stelidota geminata* are considered economic pests and *Colopterus niger*, *Cryptarcha striatula*, *Euraea rufa*, *Lobiopa undulata*, and *Omosita colonae* being designated locally rare. The Overton site revealed 23 species with *Glischrochilus quadrisignatus*, *G. fasciatus*, *Carpophilus lugubris*, and *Stelidota geminata* being economic pests. The locally rare species for Overton include *Carpophilus brachyotus*, *C. antiquus*, *C. marginatus*, *C. marginellus*, *C. sayi*, *Colopterus niger*, *Omosita colon*, and *Euraea peltoides*.

At least three species from each site are awaiting determination. This study will allow us to observe fluctuations in overall abundance and richness of Ohio's nitidulids as environmental changes occur in the future.

Board D ALTERNATIVE METHODS FOR CAVITY ENCLOSURE IN TREES. Trevor F. Vidic, The Davey Tree Expert Company, 1500 N. Mantua St., Kent, OH 44240.

The concept of compartmentalization of decay in trees (CODIT) has stimulated a reappraisal of the methods modern arborists use to promote tree wound and cavity enclosure. Current technique involves use of non-abrasive materials to completely fill cavities after standing water and wood debris have been removed, trimming a plane on exposed fill for callus and wound wood tissue to move across, and painting the trimmed fill with asphaltum dressing to enhance durability. The proposed alternative method does not involve completely filling large tree cavities since fill material does not provide a support function; instead, a screen is attached just inside of a cavity aperture as backing for a narrow "wall" of durable material that can be trimmed flush with the tree's outer circumference and textured and painted with nonphytotoxic exterior house paint for aesthetics and protection. Screened cavities help promote wound wood response while denying water and animals (such as tree hole mosquitoes) access to the hollow. No fungicidal materials, chiseling out of sound wood, or installing tubes to drain water should be employed in modern cavity treatments.

Board E MIGRATING BIRDS RECOVERED AT YOUNGSTOWN TV TOWER. Randy C. Jones, 417 S. Main St., Poland, OH 44514.

Volunteers salvaged fall migrants beneath the broadcast tower of WFMJ-TV from 1974 through 1992 under permit from appropriate agencies. All specimens were presented to Carnegie Museum of Natural History (Pittsburgh) and identifications made. The numbers killed annually have tended to decline over the study period. A compilation of the kill, principally warblers and vireos, is shown by year for the most abundant species. Totals are grouped by winter and summer residency and the trends compared.

Board F COVER-SEEKING BEHAVIOR IN CRAYFISH. Craig W. Steele, Philip A. Alberstadt and Carol Skinner, Dept. of Biology & Health Services, Edinboro University, Edinboro, PA 16444.

We examined the relative importance of darkness and thigmotactic cues in the cover-seeking behavior of adult *Orconectes rusticus*. Crayfish ( $n=12$  per experiment) were observed in individual aquaria five times per day, with at least 30 minutes between observations, for three days. Their position was recorded as within or outside the provided cover; data was analyzed with one-way, repeated measures ANOVA. When presented with a clear, thigmotactic cover versus open area (experiment Ia), crayfish were in the cover significantly more often ( $P<0.0001$ ); with a dark, thigmotactic cover versus open area (experiment Ib), crayfish were also in the cover significantly more often ( $P<0.0001$ ). In experiment II, crayfish were given a simultaneous choice among a clear, thigmotactic cover, a dark, thigmotactic cover, and open area. They chose the dark, thigmotactic cover significantly more ( $P<0.0001$ ), and were never observed in the clear, thigmotactic cover. Although a clear cover was acceptable in experiment I when no alternative was available, the addition of darkness created a more desirable condition. Experiment III was designed to assess how they would choose between darkness without thigmotactic cues versus thigmotactic cues without darkness. Crayfish were given a simultaneous choice among a large, dark cover, a clear, thigmotactic cover, and open area. They chose the large, dark cover significantly more than open area ( $P<0.02$ ), but not significantly more than the clear, thigmotactic cover. Those animals which used the clear, thigmotactic cover pulled gravel into the cover, thus providing a measure of shadow, something which they did not do in experiment Ia. Thus, darkness may have greater importance in controlling cover-seeking behavior in a simultaneous discrimination test.

Board G IMPACT OF TRICHLOROETHYLENE CONTAMINATION ON BENTHOS OF LITTLE BEAVER CREEK AT THE PORTSMOUTH GASEOUS DIFFUSION PLANT (PORTS) IN PIKETON, OHIO. Jennifer L. Alley and Gary W. Snyder, Martin Marietta Energy Systems, Inc., PO Box 628, Piketon, OH 45661.

The X-230J7 Holding Pond at the PORTS Reservation receives water from process cooling water blowdown and surface runoff. The East Drainage Ditch (EDD) drains the X-230J7 Pond; EDD discharges into Little Beaver Creek (LBC). Trichloroethylene (TCE) was used as a degreasing agent at PORTS until the mid-1980's and has been detected in groundwater. Chemical data reveals a history of TCE contamination from July, 1991 to November, 1991. Observation of the invertebrate fauna in EDD indicates that organic pollution is present within the stream. There is qualitative evidence that dense populations of Chironomids (considered as good indicators of organic pollution) are present in EDD. Observations indicate poorest water quality in LBC at the point of confluence with EDD; downstream of the confluence with LBC water quality appears to improve. Macroinvertebrates were sampled using a .9m subur sampler. Chemical analyses were performed on water in areas which corresponded with the macroinvertebrate sampling points. All data illustrates that chironomids are most abundant in EDD (where Volatile Organic Compounds [VOCs] are highest) with populations decreasing in

LBC downstream. Conversely, Ephemeroptera, Plecoptera, and Tricoptera (EPT) were least abundant in EDD and increased downstream as VOC concentrations decreased.

Board H INFLUENCE OF FOLIAR NITROGEN AND WATER CONTENT OF CO<sub>2</sub> FUMIGATED WHITE OAK GYPSEY MOTH PUPAL WEIGHT. W. N. Cannon, Jr., J. H. Barger, USDA-Forest Svc., 359 Main Rd., Delaware, OH 43015; and R. W. Hall, Dept. of Entomology, The Ohio State University, Columbus, OH 43210.

Atmospheric CO<sub>2</sub> levels are projected to increase from the ambient concentration of 325 ppm to 650 or 700 ppm by the year 2100. Elevated CO<sub>2</sub> levels may alter foliage qualities that affect insect herbivore food consumption and growth. We evaluated gypsy moth (*Lymantria dispar* L.) pupal weight after larvae (from the 2nd instar on) completed their development on foliage of 3-yr.-old white oak (*Quercus alba* L.) seedlings fumigated with 2X ambient concentration of CO<sub>2</sub> (ca. 650 ppm). Leaf water content and nitrogen concentrations were determined and related to pupal weight. We found the leaf nitrogen and water contents per unit of leaf dry weight were significantly lower in elevated CO<sub>2</sub>-treated foliage. Gypsy moth was able to compensate for the differences in these factors, such that the mean pupal weight was similar for the ambient and the elevated CO<sub>2</sub> treatments. Both male and female pupal weight followed similar trends.

Board I COMPARATIVE AUXIN ACTION IN ROOTS OF WILD TYPE AND AUXIN RESPONSE MUTANTS OF ARABIDOPSIS. Linda M. Young, Hideo Ishikawa and Michael L. Evans, Ohio Northern University, Ada, OH 45810.

We adapted the video digitizer system of Ishikawa et al. (Planta 183:381) for use in measuring root elongation in 4-yr.-old seedlings of *Arabidopsis thaliana*. Root extension was recorded using the software program "ADAPT" (Ishikawa and Evans, Plant Physiol 94:913). Initial measurements were made using seedlings growing along the surface of agar plates with tip displacement recorded every minute. The growth rate of roots of wild type (Columbia ecotype) seedlings ranged from 0.164 to 0.285 mm x h<sup>-1</sup>. We are making similar measurements using the auxin response mutants axr1-3, axr-2, and aux-7 (provided by Mark Estelle, Indiana University). To compare the kinetics of the auxin response in wild type and mutant seedlings, we are constructing a narrow glass chamber in which the seedlings can be grown immersed in agar, sufficiently diluted to allow flow-through of auxin-containing solution. A longer term goal of this research is to compare the kinetics of gravitropic curvature with the kinetics of the altered auxin response in the mutants.

Board J NITROGEN SOURCE AFFECTS DIFFERENTIATION OF TRACHEARY ELEMENTS IN LACTUCA SATIVAPITH EXPLANTS. Prudence J. Hall and Ann R. Salvino, Dept. of Biology, Hiram college, Hiram, OH 44234.

Tracheary elements form in cultured explants of lettuce pith parenchyma when both a cytokinin and an auxin are added to culture media. Tracheary element differentiation is also affected by the form of fixed nitrogen supplied. On media containing NH<sub>4</sub>NO<sub>3</sub>, tracheary elements are induced within six days. On media containing only nitrate nitrogen, tracheary element induction requires nearly 14 days. Explants cultured in the absence of ammonia nitrogen also have higher fresh weights and more callus, but reduced protein concentration as compared to explants cultured on media containing NH<sub>4</sub>NO<sub>3</sub>. Qualitative differences in proteins from crude extracts as separated by SDS-PAGE and stained with Coomassie Blue have not been detected. This research is supported, in part, with funds from the Howard Hughes Medical Institute.

Board K THE EFFECTS OF COMPETITION AND HABITAT ON THE NUMBER OF NESTING ATTEMPTS BY THE EASTERN BLUEBIRD (*SIALIA SIALIS*), IN NORTHEAST OHIO. David J. Horn, Carey L. Eting, and Mary Benninger-Truax, Biology Dept., Hiram College, Hiram, OH 44234.

Thirty-four bluebird nest boxes were placed in relatively open areas at the J.H. Barrow Field Station in 1989. The boxes were checked twice weekly during the Springs of 1990 to 1992 and during the summer of 1992, and the number of nesting attempts by Eastern Bluebirds, House Wrens, House Sparrows, and mice were recorded. In 1992, the vegetation in four 2 m x 50 m belt transects was recorded for 17 of the boxes, and the distances to the nearest trees and shrubs were recorded for all 34 boxes. Nesting attempts by bluebirds were analyzed in relation to competition from other species and the vegetation surrounding each box. Multiple regression analyses showed a significant negative relationship between the number of nesting attempts by bluebirds and the number of attempts by wrens, sparrows, and mice in 1990 and 1991. In 1992, attempts by mice had a significant negative effect on bluebird nesting attempts. No relationship was found between the vegetation surrounding each box and the number of nesting attempts by bluebirds. This may be due to the original placement of nest boxes and/or the sampling methods used.

Board L AN EXAMINATION OF BIRD SPECIES RICHNESS AND DIVERSITY AT THE J.H. BARROW FIELD STATION IN NORTHEAST OHIO. David J. Horn and Mary Benninger-Truax, Biology Dept., Hiram College, Hiram, OH 44234.

Bird surveys were conducted at the J.H. Barrow Field Station during the fall of 1989, the fall, winter, and spring of 1990, and the summer of 1992. The number and species of birds seen or heard were recorded during each survey, and the habitat in which each species was found was recorded during the 1992 surveys. Differences in species richness (number of species/number of individuals) and species diversity ( $H'$ ; Shannon index) were examined in relation to season and habitat. Preliminary results indicate that species richness was greatest during the spring and fall and in viney areas, fence rows, and stream habitats; species richness was lowest during the summer and winter and in pond areas, old-fields, and an old-growth forest. Species diversity was highest during the summer of 1992 and in stream habitats, mowed areas, and early successional forests; diversity was lowest in the winter and in pond areas and agricultural fields. Results of this study will provide baseline data for future avian research conducted at the station, and a continuation of this project will allow for the examination of long-term changes in bird species diversity.

Board M CARBON CATABOLITE REPRESSION OF TRANSCRIPTION OF THE QUINIC ACID (QA) GENE CLUSTER IN *NEUROSPORA CRASSA*. David K. Asch and Mary E. Case, Dept. of Biological Sciences, Youngstown State University, Youngstown, OH 44555.

In wild-type *Neurospora crassa*, a transcription of the *qa* gene cluster is repressed in the presence of glucose. To study this phenomenon we have compared the levels of transcription of the *qa* genes in the presence of glucose in wild-type *N. crassa* and in a strain carrying a deletion of the *qa* repressor gene,  $\Delta qa-1S$ . All *qa* message levels in the  $\Delta qa-1S$  strain are constitutive whether quinic acid is present or not but differ in their responses to glucose. The message levels of the *qa-x*, *qa-2*, and *qa-4* genes are slightly repressed while message levels of the *qa-3*, *qa-y*, and *qa-IF* genes are more highly repressed. These studies also describe three classes of unlinked mutants, *cri*, *sor*, and *dgr*, which partially relieve carbon catabolite repression of *qa* gene transcription and transcription of a glucose-repressible gene (*grg*).

## POSTER SESSION FOR PRE-COLLEGE STUDENTS 1:30 P.M., Saturday, May 1, 1993 Cushwa Hall Lobby

Board A VEGETABLE FUELS. Janine D. Wiley, 3384 Peru Township Rd. 221, Marengo, OH 43334-9405.

Is your Chrysler cholesterol free? Does your Volkswagen have Wessonality? These are some of the questions I hope we will be asking in the near future. I think that we could really benefit from a new type of fuel created from recycled vegetable or plant oils. The problem is to find the best and most efficient way to remanufacture and use these new fuels to our benefit. A mixture between 25% and 35% vegetable oil and methanol can work as a substitute for diesel fuel. It can work better than normal diesel fuel.

Board B ATMOSPHERIC EVOLUTION. Alfredo J. Garcia, 1348 N. Detroit St., Xenia, OH 45385.

In the experiment atmospheric evolution, the problem established was to see if the addition of plant life to a simulated atmosphere composed completely of carbon dioxide would make changes in the atmosphere. It was hypothesized that the plants would make a slow change or cause the atmosphere to "evolve" into an oxygen environment capable of supporting earth's animal life. After designing, building, and placing the plants into each chamber, carbon dioxide was used to flush trapped air. A five-day growth period was implemented from February 22-27, 1992. During this time, plants received a sufficient amount of distilled water and artificial light. There was a growth among the moss, and the experiment was proceeding as planned, but leaks in the chamber were found, creating partial bias in data collected. In conclusion, the results of the experiment were as hypothesized: The plants caused the atmosphere to evolve but because data was partially biased, the experimental design must be reconsidered and the experiment repeated to achieve more precise and accurate data.

Board C EFFECTS OF DIMETHYL SULFOXIDE ON THE REGENERATION OF EARTHWORMS AND PLANARIA. Nicole S. Hammond, 3380 Mapleview Trail, Atwater, OH 44201.

This experiment was conducted to determine if dimethyl sulfoxide (DMSO) assists in the regeneration and repair of tissues. This experiment was divided into two sections: The first section was conducted using *Lumbricus terrestris* (earthworms). They were divided into two groups. With the first group of 14 earthworms, one inch was removed from the posterior end. Two inches were removed from the posterior end of the second group; the second part of the experiment was performed upon planaria. The first ten planaria were cut in half. The second ten planaria were separated by the tail. Both the planaria and the earthworms received 76% DMSO. Varying dilutions of DMSO in water were used. Results of these experiments showed that DMSO

does have an effect on the repair and regeneration of tissues. Of the ten planaria, in which the tails were separated, the five treated with DMSO regenerated at a rate 75% faster than those not treated with DMSO. The five planaria, in which the body was separated, regenerated new bodies 71% faster. Of the 24 earthworms, in which one inch was removed, the twelve treated with DMSO regenerated at a rate 50% faster. The 12 earthworms, in which two inches were removed, regenerated 53% faster. The solutions which worked the best were 70% dimethyl sulfoxide and 30% distilled water—with the planaria 35% DMSO and 65% distilled water, showing optimal results.

Board D A MOLECULAR UNDERSTANDING OF AQUATIC SYSTEMS. Carrie E. Vonderhaar, 10451 Wycaryer Rd., Evendale, OH 45241.

The purpose of this investigation is to acquire a molecular understanding of aquatic systems. In pursuing this investigation, analysis of a system (water from Buck Creek) will be analyzed for oxygen content and organisms living in this specific habitat. Techniques and methods used in this analysis will include: 1. nets 2. grabs 3. artificial substrates, and 4. the Winkler Method. This scientist intends to verify and isolate those factors and organisms which would cause variations in the fundamental reactions involving the determination of dissolved oxygen by the Winkler Method using samples from upstream and downstream sites.

Board E THE FACTORS INFLUENCING TRANSFORMATION EFFICIENCY OF *E. COLI* MM294 BY MEANS OF THE PLASMID pAMP. Emily E. Ellis, 800 Allison Rd., Bellefontaine, OH 43311.

This project dealt with colony transformation which is a method for altering the genetic characteristics of bacteria. The rapid colony transformation method described in DNA SCIENCE (Micklos & Freyer, 1990) was used. The objective was to find factors influencing the transformation efficiency of *E. coli* MM294 by means of the plasmid pAMP. Specifically, the experiment dealt with finding the salt which produced the greatest number of transformants. It was previously determined that a 30-second heat shock produced more colonies than the standard 90-second heat shock (Ellis, 1991). This impacts the standard lab procedure because it saves 60 seconds of time while running a colony transformation. The present study examined the impact of various monovalent and divalent salts as a factor in the rapid colony transformation. Six basic salts were used. They were calcium chloride ( $\text{CaCl}_2$ ), which is used in the standard lab procedure, rubidium chloride ( $\text{RbCl}$ ), magnesium chloride ( $\text{MgCl}_2$ ), lithium chloride ( $\text{LiCl}$ ), potassium ( $\text{KCl}$ ), and manganese chloride ( $\text{MnCl}_2$ ) treatment with monovalent salts produced the lowest efficiency of cells. The only two divalent salts which produced transformants were calcium chloride and magnesium chloride. Although calcium chloride is the salt used in the standard lab procedure, this study indicates that magnesium chloride could also be successful in colony transformations.

Board F THE ACCEPTANCE OF RECOMBINANT DNA PLASMIDS BY AQUATIC GRAM NEGATIVE BACTERIA. Heather R. Kegg, 1496 RD 179, Bellefontaine, OH 43311.

This paper demonstrates that the recombinant plasmid R68 contained in *Pseudomonas aeruginosa* (later *Pseudomonas putida*) will readily transfer into gram negative aquatic bacteria. (It will also strive to give accurate percentages of this happening in a natural environment). *Pseudomonas aeruginosa* (later *Pseudomonas putida*) containing the recombinant plasmid was made nalidixic acid or tetracycline resistant. Recipients, which were isolated from Mad River in Logan County, Ohio, were made rifampicin resistant. Then donor and recipient strains were mated. The resulting growth was plated on nutrient agar plus tetracycline plus rifampicin. This way, only the recipients which received the plasmid would grow. Plasmid screens were then run. The success rate was nearly 100%. The results of successful matings in a natural environment are still pending. This paper clearly shows that the likelihood of recombinant DNA plasmids transferring to other organisms in the environment if they should be released is great. Great care should be taken in monitoring experiments with recombinant DNA plasmids. A natural environment was simulated by a ten gallon aquarium filled with water from the same river mentioned above.

Board G WATER QUALITY OF INDIAN FORK RIVER/ATWOOD LAKE RESERVOIR. Latrice DuBose, William Hannon, Christopher Smith, Paul Bilman, Bryan Becker, Bill Ullom, Rachel Gianfagna, Stephanie King, and Mike Harris, McKinley Senior High School, 2323 17th St. NW, Canton, OH 44708.

Researchers' purpose was to determine water quality of the Indian Fork streams serving as inflow and outflow areas for the Atwood Reservoir. Researchers predicted the inflow stream would be supportive of more benthic organisms than in the outflow. We divided groups for sampling, collecting, and chemical testing. The information was organized on a contour map including water depth, stream length, and flow rate. The researcher's findings for the inflow site were as follows: Simuliidae (blackfly larvae), Coleoptera dytiscidae (water beetle), Tabanidae (biting fly), and Chironomidae. Chemical results were pH - 6.0 to 6.4, nitrate - 4.4 ppm, hardness - 120 ppm, dissolved oxygen - 17 ppm, chloride - 34 ppm (+/- 2 ppm), and alkalinity - 74 ppm. The researchers' findings for the outflow site were as follows: Trichoptera (caddisfly larvae), Simuliidae, and Odonata (dragonfly nymphs). Researchers did two chemical tests for the outflow.

Researchers' results were as follows: pH - 6.8 to 7.0, nitrate - less than 1.1 ppm, alkalinity - 68 to 74 ppm, hardness - 96 to 104 ppm, chloride - 16 to 17 ppm, dissolved oxygen was 16 to 17 ppm. Researchers also tested lake backwater for dissolved oxygen to determine the dam's effect on dissolved oxygen readings. Dissolved oxygen in the lake was 8.4 ppm. Researchers determined that the outflow has a higher water quality than the inflow.

Board H THE EFFECTS OF IONIZING RADIATION ON *LYCOPERSICON ESCULENTUM*. Alexander J. Seidensticker, 4 Shawnee Dr., Chillicothe, OH 45601.

In this experiment, I observed the effects of ionizing radiation from a Cobalt-60 source on *Lycopersicon esculentum* which had been radiated during germination. I used two groups of plants which were germinated on different days. The first group (Group A) was planted five days before being radiated while the second group (Group B) was planted one day before germination. Each group was divided into four sub-groups which were radiated with different amounts of radiation (except for a control group in both Groups A and B) which received no radiation. Three sub-groups from both Group A and Group B were radiated. The sub-groups in Group A were radiated with 10, 20, and 30 Rads of radiation while the sub-groups in Group B received 250, 500, and 1,000 Rads of radiation. Six plants were used for each group. All plants were grown in a commercial hydroponic apparatus and solution. Measurements were recorded for Leaf Length, Leaf Width, Stem Length, First Blossom Date, First Fruit Date, and the Longevity of the Plants.

Board I AN ANIMAL MODEL TO EXAMINE THE TERATOGENIC EFFECTS OF ANTI-EPILEPTIC DRUG VALPROIC ACID. Smita De, Cincinnati Country Day School, Attn: Richard O. Schwab, 6905 Given Rd., Cincinnati, OH 45243; Work done with Claire M. Schreiner and Dr. William J. Scott, Jr. Children's Hospital Medical Center, Dept. of Pediatrics, University of Cincinnati.

Valproic acid (VPA) is known to cause spinabifida (defect in the lower spinal column) in the offspring of epileptic women. To understand how VPA causes this malformation, it is important to find an appropriate animal model in which studies to elucidate VPA's mechanism of action can be conducted. In this study, seven pregnant animals of the C57BL/6 strain of mice were injected subcutaneously with VPA (300 mg/kg) twice on day nine of gestation. On day 18 of gestation, dams were sacrificed, the fetuses removed, examined grossly for malformations, and live fetuses were prepared for skeletal examination. Of the 63 implantation sites examined, 16 (25%) were resorbed and 47 (75%) were alive. Skeletal examination revealed limb malformations in 21 (49%) fetuses, and cranial malformations in 26 (55%) fetuses. The anomalies of main interest, vertebral malformations, were seen in 37 (78%) fetuses. Vertebral malformations included missing, fused, or bifurcated vertebrae; and missing, split, or hemi centra. In a few fetuses (4%), an extra vertebrae was observed. Spinabifida is extremely difficult to produce in mice and was not observed in this study; however, missing vertebrae in the lumbar/sacral region of the mouse, as observed in this study, indicates the two abnormalities are similar. This study suggests that the C57BL/6 mouse strain is acceptable as an animal model for continuing studies on valproic acid.

Board J DO SPECIFIC ODORS HAVE A POSITIVE EFFECT ON MEMORY AND LEARNING? Brett T. Perala, 600 Eastwood St., Geneva, OH 44041.

I hypothesized that short-term memory and learning ability would be enhanced while subjects were exposed to the ambient odors of essential natural oil of peppermint, rosemary, and lemon. My procedure included administering two sets of three memory tests to an experimental group and a control group. Both groups were composed of 12/13 year old students homogeneous in intellectual ability and having an adequate sense of smell, as demonstrated by their performance on the National Geographic Smell Survey. In trial one, the experimental group was tested in the presence of the ambient odor while the control group was tested with no odor present. In trial two, both groups were tested while in the presence of the ambient odors. My hypothesis was supported by the results of the experiment as follows: In trial one, the experimental group performed dramatically better than the control group. In trial two, the control group improved their scores. I concluded that, as demonstrated in my experiment, exposing test-takers to a specific ambient odor does have a very definite and positive effect on short-term memory.

Board K POSITIVE GRAVITROPIC RESPONSE: WILL UNORTHOGRAVITROPIC ROOTS RETURN TO A VERTICAL POSITION IF DEPRIVED OF THEIR ROOT CAPS? Aaron R. Herrstein, 178 St. Andrews Place, Chillicothe, OH 45601.

Positive gravitropism is the downward curvature of roots due to gravity. The purpose of my experiment was to determine if the root caps of plants contain statoliths which perceive that the roots have been moved from their vertical position. Plastic containers lined with cheesecloth were marked at angles to make it possible to see any changes that occurred in root growth. Five or six plants were used in each experiment. Seedlings or root cuttings were used because tropisms occur quickest in growing organs. Plants with a tap root and no or few secondary roots were used because primary roots are generally oriented more vertically than secondary roots, which sometimes grow at a rather constant, nearly horizontal angle to explore the soil more thoroughly.

Three plants were used as controls: A-a normal plant in a vertical position; B-a plant placed horizontally; and C-a plant in a vertical position with the root cap removed. Two or three experimental plants were deprived of their root caps and turned on their sides. Photographs were taken and progress noted at regular intervals. Time length varied in each experiment before the Control B roots grew down. Controls A and C grew normally. The experimental plants' roots did not grow down because they had no root caps and no perception of gravity.

Board L THE CASE AGAINST BAR SOAPS. N. Reid Perala, 600 Eastwood St. Geneva, OH 44041.

To prove my hypothesis that washing with in-use bar soaps would transfer microorganisms from the bars to my hands, I cultured bacteria from the bars and my hands before and after washing. Bacteria was present in increasing amounts on my hands after washing with five in-use bar soaps and one liquid soap. Six trials were conducted over the life of the bars. I also cultured bacteria from each test soap to determine whether the soaps harbored bacterial colonies and analyzed the amount and types of bacteria present. The procedure used included sterilization, contamination, inoculation, disinfection, reinoculation, and inoculation using strict controls. Each of the bar soaps showed decreasing effectiveness as antimicrobial agents during repeated use while the effectiveness of the liquid soap remained relatively constant. Bacteria was present in increasing amounts on my skin after washing with the bar soaps with each successive trial, while bacteria cultured from my hands after washing with the liquid soap remained constant. My research indicated that washing with in-use bar soaps will deposit micro-organisms on skin surfaces.

Board M ARE FRACTURES FRACTALS? Elif Konuk, 1502 Markland St., Columbus, OH 43235.

Geometry, or earth measures, was created for just that - to describe and "measure" the earth, but there are some shapes and patterns in nature that cannot be described by Euclidean geometry. Fractal geometry, created by Benoit Mandelbrot, describes these shapes as being self-similar, which means there is a repetition of a pattern within their design. In this experiment, I attempted to determine if ice and glass fractures are fractals. To do this, I fractured different-sized blocks of ice and glass to show that the fracturing pattern is self-similar. I calculated the fractal dimension of each of the fractured ice blocks and compared them. I wrote a program in "C" language which simulates ice breaking by dividing a square into four smaller squares. These smaller squares are further divided and so on until the smallest square is reached. I used a random number generator with modifier functions to decide if a square will "break" or be divided. In my next experiment, I attempted to determine the fracturing patterns of glass to a more accurate degree. I have also translated my computer program into Pascal language and modified it so that it simulates my last experiment in displaying the angles of the fractures.

## POSTER SESSION

2:30 P.M., Saturday, May 1, 1993

### Cushwa Hall Lobby

Board A A POTENTIAL USE FOR CRANBERRY JUICE COCKTAIL IN THE TREATMENT OF PATIENTS WITH CHRONIC URINARY TRACT INFECTIONS, Mary Elizabeth Wollet, Kevin L. Scheetz and Anthony E. Sobota, Youngstown State University, Dept. of Biological Sciences, Youngstown, OH 44555.

Of the women who experience a urinary tract infection (UTI), 20% will develop chronic UTI. This study set out to determine if cranberry juice cocktail (CJC) contains components that exhibit anti-adherent activity. Fructose showed significant anti-adherent activity in the urine of 100% of normal subjects and in 84% patients with chronic recurrent (>3/year) urinary tract infection. A second non-dialyzable component of CJC also showed significant anti-adherent activity in 64% normals and in 79% patients with chronic UTI. Six patients with chronic UTI were receiving CJC daily for over one year. In these patients the addition of fructose or the non-dialyzable fraction of the CJC showed no decrease in adherence. Controls of patients on CJC daily and chronic patients with added fructose showed no significant difference. These results suggested that CJC may be beneficial in decreasing bacterial adherence and infection in patients with chronic UTI.

Board B GALLBLADDER INTERPOSITION IN SHORT BOWEL SYNDROME. Marc T. Downing, Abid H. Khan, James A. Obney, Ariel E. Birnbaum, Medical College of Ohio, Dept. of Surgery, 3000 Arlington Ave., Toledo, OH 43699.

Since adequate surgical treatment of short bowel syndrome does not exist, this pilot study evaluates the feasibility of placing the gallbladder in direct continuity with the intestinal tract. A canine model was examined in which two anesthetized (sodium pentobarbital 75 mg/kg) 25 kg male mongrels had eighty percent of their small intestine resected which remained in the abdominal cavity and was drained as a mucus fistula. The experimental animal had the gallbladder anastomosed between the proximal jejunal and distal ileal segments. Both subjects survived the six-week study period and demonstrated similar stool frequency, stool consistency,



fecal fat, body weight, and serum albumin. Significant submucosal cacatrix formation of the gallbladder without notable changes in the mucosal surface were revealed on histologic section. No significant differences in small intestinal histology were evident between these two subjects. Therefore, gallbladder interposition has been shown to be technically feasible and may potentially be a practical consideration for patients with short bowel syndrome.

**Board C INTRA-SPECIES DIFFERENCES IN THE THYROID AND LIVER LEVELS OF THYROID HORMONES IN NORWAY RATS.** David Pittman, Armando G. Amador and Robert D. Hilgers, Dept. Obstetrics/Gynecology, SIU School of Medicine, Springfield, IL 62794-9230.

We have previously shown that major differences in endocrine parameters exist among different strains and stocks of rats (Amador et al, 1988, 1989; Amador & Mayerhofer, 1992). These included differences in circulating thyroxine levels. The present study was undertaken to analyze further the differences that might exist in thyroid hormone metabolism among stocks of rats. Thus, thyroid and livers from adult male and female Long-Evans (LE), Wistar (W), and Sprague-Dawley (SD) were obtained and weighed. Thyroids and central hepatic lobes were homogenized. Tissue thyroxine (T4) and triiodothyronine (T3) levels were then measured using solid-phase radioimmunoassays. Male LE rats had larger thyroids than any other type of rat. No gender-related differences in thyroid weight were observed in W and SD rats. Male LE rats had the heaviest livers, and female LE the lightest. Liver weight differences were observed in LE and SD, but in W rats, male LE and female SD rats had the highest thyroid T4 levels, and W rats had the lowest. Male LE had higher thyroid T4 than females, and conversely male SD had lower levels than females. Thyroid T3 levels were highest in male LE rats, and lowest in W rats. Male LE rats had higher thyroid T3 content, but not concentration, than females. Male SD rats had the highest levels of liver T3, and female SD had the lowest. In all stocks, male rats had higher liver T3 than their female counterparts. The thyroid TE/T4 ratio was higher in W than in other rats. The liver T3/thyroid T4 and liver T3/thyroid T3 were highest in male W rats, and lowest in female SD. Gender-related differences in these ratios were observed in W and SD, but not in LE rats. The present results indicate that there are intra-species and inter-gender differences in thyroid hormone metabolism. Furthermore, there is a differential genetic regulation for the thyroidal and hepatic metabolisms of thyroid hormones. These studies were supported by the SIU-OB/GYN Research Fund.

**Board D THE METABOLIC RESPONSE TO TRAUMA IN DIFFERENT AGES OF RATS.** Q. Sun and R. Birkhahn, Dept. of Surgery, Medical College of Ohio, Toledo, OH 43699.

The metabolic response to trauma as commonly measured in growing rats (two months old, weighing about 200g) was compared to adult rats (nine months old, weighing about 500g). Resting energy expenditure (REE) was measured from CO<sub>2</sub> output and O<sub>2</sub> uptake and nitrogen balance (NB) from the difference between 24-hour intake and urinary output. After six days of baseline REE and four days of baseline NB measurements, rats were traumatized by bilateral femur fracture. Groups for young rats were trauma (n=5) and control (n=5); and for adult rats were trauma (n=5) and control (n=5). Liquid diet and water were provided *ad libitum* to all rats throughout the experiment. REE and NB were measured daily for seven days after stress. Growing trauma rats had increased REE on days 1, 4, 5, 7 and 65% decreased NB on days 1, 2, 3 post trauma compared to control values. For adult rats, trauma increased REE for seven days and the peak increase of 21% on day three compared to their controls. NB was decreased from day two through day six with the minimum of 73% on day four compared to their controls. This study shows that the magnitude of the metabolic response in trauma is similar for growing and adult rats but lasts longer for adult rats. Supported by grant GM 39239.

**Board E EFFECT OF AGING ON LIVER MINERAL PROFILE OF RATS.** Augusta Askari, Eugene Orłowski, Henry Okonta, Qing Yang, Effie M. Lee, Ronald H. Birkhahn, Medical College of Ohio, Toledo, OH 43699.

Since liver is a vital site for metabolism, since age and gender impact physiological activity, and since minerals are important participants in such reactions, this study evaluates and compares Zn, Cu, Fe, Mn, Ca, Mg, Na, and K levels in livers of male (M) and female (F) Sprague-Dawley rats two (n = 4F; 6M) or nine (n = 8F; 7M) months old. Liver/body weight ratios were similar for same age M and F rats. Liver slices were wet digested by concentrated nitric acid. Mineral levels were measured by atomic absorption. Significant differences were observed for Mn, Ca, Mg, Na, K in two vs. nine months M; for Mn, Ca in two vs. nine months F; for Mn in two months M vs. F; for Cu, Fe in nine months M vs. F. Therefore, aging affects more minerals in M than F livers; however, gender differences are not as pronounced. (Funded, in part, by NIH GM 39329).

**Board F CALCIUM SUPPLEMENTATION AND ISOMETRIC EXERCISE: INTERACTION OF EFFECTS ON REGULATION OF RESTING BLOOD PRESSURE.** Stephanie E. Reichert, Kelly J. Kohls, Ron L. Wiley, Family and Consumer Sciences Dept., Miami University, 260 McGuffey Hall, Oxford, OH 45056.

A pilot study was conducted utilizing seven adult subjects. These subjects were the offspring of at least one hypertensive parent. The study consisted of a one week pre-period, five weeks of treatment in one of the following groups: calcium supplement alone, calcium supplement plus

isometric exercise, isometric exercise alone, or no treatment. The post-period consisted of four weeks of follow-up. Subjects consumed their own self-selected diets which were recorded. Subjects involved in the isometric exercise groups utilized a handgrip dynamometer five days per week. Urine samples were collected immediately prior to handgrip, immediately following handgrip and at 30 min. and 4 hr. intervals post-handgrip. Preliminary data suggests an increased urinary excretion of sodium immediately following the handgrip. Preliminary data also suggests a blood pressure lowering effect of subject participating in isometric exercise. Urinary excretion of sodium and potassium, blood pressure response to calcium supplementation, and isometric exercise will be presented.

**Board G REDUCTION OF GAP JUNCTIONAL INTERCELLULAR COMMUNICATION BY TUMOR PROMOTERS AND CELL TRANSFORMATION IN MOUSE LUNG EPITHELIAL CELLS.** Rakhi K. Chaudhuri and Randall J. Ruch, Dept. of Pathology, Medical College of Ohio, 3000 Arlington Ave., Toledo, OH 43699.

Gap junctional intercellular communication (GJIC) is thought to play a role in cellular growth control and phenotypic regulation. Tumor promoters and neoplastic transformation have been shown to reduce GJIC in many tissues but little data exist for the lung. In the present study, we determined the levels of GJIC in non-transformed (C10) and transformed (E9, 82-132, and PCC4) mouse lung epithelial cells and the effects of tumor promoters (TPA, DDT, BHT, and phenobarbital) on lung cell GJIC. Levels of GJIC were determined by fluorescent dye microinjection and were highest in C10 cells (82.2-85.9%), followed by 82-132 cells (25.3%-46.8%), E9 cells (17.6%-21.3%), and PCC4 cells (0-7.1%). TPA, DDT, and BHT inhibited GJIC in C10 cells in a dose-responsive fashion, whereas phenobarbital had no effect. The data indicates that GJIC is reduced in mouse lung cells by neoplastic transformation and treatment with certain tumor promoters. (Supported by NCI grant CA57612 to RJR).

**Board H BIOCHEMICAL COMPARISON OF THE PROTEIN KINASE ENCODED BY HERPES SIMPLEX VIRUS TYPES 1 AND 2 BY THE US3 GENE.** Lisa A. Alshouse and Darlene G. Walro, Dept. of Biology, University of Akron, Akron, OH 44325-3908.

The US3 gene of herpes simplex virus type 1 (HSV-1) encodes a protein kinase which shows 85% homology at the predicted kinase domain and 60% homology at the amino and carboxy termini with the US3 gene of HSV-2. The aim of this study was to determine if biochemical differences in the proteins exist. The HSV-2 encoded protein kinase was partially purified from the cytosolic fraction of virus-infected cells using ion-exchange and affinity chromatographic methods previously used to isolate the HSV-1 encoded protein kinase (Purves et al., Eur. J. Biochem. 167: 507-512). The HSV-2 protein eluted from DE52 at 0.22M KC1 similar to the HSV-1 enzyme but did not bind to CM52 or threonine-agarose under conditions which bound the HSV-1 enzyme. The HSV-2 enzyme bound irreversibly to protamine agarose, unlike the HSV-1 enzyme which eluted at 0.8M KC1. Both species of enzymes utilized ATP but not GTP as a phosphate donor, and both preferred protamine and lysine-rich histones as substrates rather than casein, bovine serum albumin, arginine-rich histones, or total histones. Neither species of enzyme was sensitive to heparin. Optimal activity of the HSV-2 protein occurred at 40mM MgCl<sub>2</sub> and 0.4M KC1, whereas the HSV-1 protein exhibited optimal activity at 50mM MgCl<sub>2</sub> and 0.6M KC1. Both enzymes exhibited optimal activity at pH 8.0.

**Board I KIDNEY ZINC AND COPPER LEVELS IN MALE AND FEMALE TRAUMA RATS.** Eugene Orłowski, Henry Okonta, Qing Yang, Augusta Askari, Ronald H. Birkhahn, Medical College of Ohio, Toledo, OH 43699.

Males (M) respond to trauma with greater catabolic protein losses than do females (F). Kidneys are the usual route of elimination for such nitrogen and associated minerals. Since Zn and Cu are trace minerals essential for protein structure and defense against free radicals, this study compares Zn and Cu kidney levels of 9 month old male (n = 14) and female (n = 16) Sprague-Dawley rats. Rats were individually caged, fed oral diets *ad libitum* prior to anaesthesia with ip ketamine/HCl plus acepromazine, and then half received the trauma of bilateral leg fractures. All kidneys were collected on day 5 post-trauma. Kidney Zn and Cu content were analyzed by atomic absorption. Significance was seen for Cu in M trauma (T) vs. M control (C), for Zn in MT vs. FT and in MC vs. FC. Thus, while kidney Zn levels of M appear to respond more strongly than those of F to trauma, this may be due to inherent gender differences. Cu in MT vs. MC may more truly reflect impact of trauma. (Partially funded by NIH GM 39329).

**Board J DIRECTED MUTATION: ARE MUTATIONS ALWAYS SPONTANEOUS AND RANDOM?** Tricia Len and Anthony E. Sobota, Youngstown State University, Dept. of Biological Sciences, Youngstown, OH 44555.

The term directed mutation describes those mutations occurring as a specific response to stress. *Escherichia coli* strain K 12, lac<sup>(F+)</sup> was used in this study. Overnight cultures were plated on MacConkey's basal media or MacConkey's basal media plus lactose. Revertants to lac<sup>+</sup> which occur within four days of plating are considered to be due to phenotypic lag. Revertants, produced after four days, which can be observed as red papillae on larger white colonies, are considered to be a result of mutations occurring after plating. The data shows an increase in the

number of lac<sup>+</sup> revertants growing in the presence of lactose. It has been suggested that this observed increase is due to transcriptional bias. This hypothesis suggests that during transcription the DNA of the lac operon becomes single-stranded and more vulnerable to mutation. In the strain we are using there is a mutation in the lac I gene that allows constitutive transcription of the operon and thus the DNA in this region is continually in a single stranded state. However, with this strain, we find an increase in revertants only in the presence of lactose suggesting that another mechanism may be operating in this operon.

**Board K A ONE STEP METHOD FOR THE RECOVERY OF UNSTAINED DNA FROM AGAROSE GELS.** Philip J. Orlando and Anthony E. Sobota, Youngstown State University, Dept. of Biological Sciences, Youngstown, OH 44555.

Currently there are several problems associated with the recovery of DNA from agarose gels including 1) contamination with agarose and/or ethidium bromide; 2) failure to quantitatively recover high molecular weight DNA; and 3) the potential of ethidium bromide stained DNA to become photo nicked with UV light. This study discusses a rapid, simple, and efficient technique for the recovery of DNA fragments from agarose gels which has none of these limitations. Gels are cast with an additional comb in place which allows the formation of an additional set of wells. Electrophoresis is performed directly on an ultraviolet transilluminator which permits the monitoring of pre-stained DNA as it migrates through the gel and into the preformed wells. The pre-stained DNA is used as a tracer for identical unstained DNA in a parallel lane so that unstained DNA can be recovered directly from the gel. Additional purification, concentration, or manipulation of the recovered DNA fragment is not necessary. This technique may be particularly useful for purifying PCR fragments away from primers, primer dimers, dNTPs, proteins and salts from the reaction mixture.

**Board L APPLYING GENETICS AND EVOLUTIONARY ALGORITHMS TO A PROGRAM TO MODEL GENETIC DIVERSITY.** I. Scott, Ohio Department of Health, Health Assessment Branch of the Bureau of Epidemiology and Toxicology, Division of Preventive Medicine, 246 N. High St., Columbus, OH 43266-0588.

This model builds upon current information about the genetic organization which results in the build-up of evolutionary diversity. This algorithm is a general population-based model that allows the computer to imitate some of the processes that have been observed in biological evolution. The genetic processes underlying evolution can be represented in a form which will allow calculation of maximum diversity. This model will also include factors such as fitness, low survival rates, and genetic inferiority. It will show how diversity can be built-up by allowing weak or inferior mutations to survive. Steps in the model include assigning survival rates to genetic mutations and also considering the effects of interactions and combinations of genetic mutations. The effects of initial conditions and of population growth are also considered. Such systems might be used in computer modeling of other dynamic systems

**Board M A COMPARISON OF FOLDING IN PHYSICAL MODELS AND A NATURAL FOLD, WOLF CREEK, BIG HORN MOUNTAINS, WYOMING.** Claudia E. Castro, Dept. of Geology, University of Akron, Akron, OH 44325.

A basement involved fault-propagation fold at Wolf Creek, Bighorn Mountains, Wyoming was analyzed and compared to physical models. The structure is well exposed and consists of an asymmetric anticline-syncline pair with the anticline hinge truncated by a thrust fault. The fold is angular, with narrow hinge zones and planar limbs; the interlimb angle is 85°. Oriented samples from the Ordovician Bighorn dolomite formation were collected throughout the syncline and analyzed microscopically. Samples taken in or near the fold hinge were more deformed than those collected from the limbs. This is interpreted to suggest that the hinges remained fixed in place during folding and did not migrate, as has been proposed in some other models. Physical models were used to examine the progressive evolution of folding. The models consist of clay layers deformed over wood blocks simulating faults with dips of 30°, 45°, 60°, and 75°. Patterns produced by modeling are similar to those observed in the field and support this interpretation of the development of the Wolf Creek structure.

**Board N BASEMENT-INVOLVED DEFORMATION, LAPRELE ANTICLINE, CONVERSE COUNTY, WYOMING.** John T. Imhoff, Dept. of Geology, University of Akron, Akron, OH 44325-4101.

Data collected at the LaPrele anticline, northern Laramie Range, Wyoming, has provided insight into the relationship between deformation of sedimentary rocks and the underlying isotropic basement rocks. The sedimentary rocks involved in the deformation can be divided into two structural-lithic units. The lower unit consists of Cambrian-Pennsylvanian sandstones and limestones; the upper unit is composed of Permian-Cretaceous shales with minor, thin-bedded limestones. The anticline is an asymmetric northwest plunging fold that was superimposed onto a larger east-west trending Laramide structure. The anticline has a sharp, kink-style hinge and planar limbs. Faulting in the southern margin of the structure placed Mississippian Madison limestone over Cretaceous rocks. Basement rocks are granitic augen-gneiss, amphibolites, and biotite schist. Shear occurred on foliations in the hinge zone of the fold and resulted in the folding of the basement rocks.

## ISSUES AND METHODS IN SCIENCE EDUCATION

9:30 A.M., Saturday, May 1, 1993

Cushwa Hall B079

Connie Hubbard, Presiding

9:30 **TEACHING NUCLEAR FUSION REACTOR ENGINEERING DESIGN.** Leslie V. Szirmay and Joseph C. Dailey, Dept. of Chemical Engineering, Youngstown State University, Youngstown, OH 44555-3020.

Almost a half century has elapsed since the construction of the first nuclear reactor for fissionable fuel that is for U-235. It was the brainchild of nuclear physicists. Today, reactors are constructed and operated routinely by engineers with background in nuclear sciences. We are now witnessing the emergence of fusion power which may provide endless, radiation-free energy to humanity in compensation to the indiscriminate usurpation of the earth's energy accumulated through billions of years. History may repeat itself, and soon there will be a need for engineers with backgrounds in fusion sciences. A course was established in dedication to this idea.

9:45 **HOW VALID ARE STUDENTS SELF-REPORTED GPAs?** K.A. Fulkerson, R.C. McClendon and P.A. Schutz, Katherine Fulkerson, 77 Fir Hill 4B8, Akron, OH 44130.

This research was designed to investigate the viability of using student self-reported GPA's instead of students' actual GPA in research on academic performance. Researchers who have investigated this question have tended to conclude that scientists are at risk when using self-reported GPA information (Goldman, Flake, & Mathison, 1990; Trice, 1990; Goldman & Flake, 1991). The purpose of this study is to examine the nature of that risk and provide additional findings for issues not dealt with in previous research. Participants in this study were 295 undergraduates at a large northeastern Ohio open admissions university. The self-report GPA data was collected during the first week of the semester. The students' actual GPAs were obtained from the students' university records. Results indicate that the correlation between actual and self-reported GPA was .76. The mean for self-reported GPA was 2.83, SD = .54, (five-point scale). The mean for the students actual GPA was 2.74, SD = .63. The mean for the difference between the self-reported and actual GPA was .10, SD = .42. The T-test for the paired comparisons between self-reported and actual GPA was  $T = 4.08$ ,  $df = 293$ ,  $p < .01$ ,  $r^2 = .05$ . These results are similar to the results found in other research that has looked at this issue. Other results that will be discussed will include gender comparisons, grade level comparisons and the differences between those who reported their perceived GPA's and those who did not state a GPA.

10:00 **ISSUES OF EQUITY: MINORITY STUDENTS AND SCIENTIFIC CAREERS.** Mary Ann Flowers and John H. Settlage, College of Education, Cleveland State University, Cleveland, OH 44115.

The disproportionately low percentage of non-whites entering into scientific careers is a consequence, not of a shortage of aptitude, but of a lack of access. Several factors have been identified as contributors to this inequity, many of which stem from the fact that a large proportion of minority students are first generation college students. The collegiate culture is distinctive from high school, with the shift of responsibility for success and failure from the teacher to the student, and the sudden granting of independence, or how to budget one's own time. First generation college students may not have the study skills and tools that will increase the likelihood of their success in college courses. Prior to entering college, minority students may experience numerous barriers in terms of an awareness of potentials. Students may not realize the array of career options in scientific careers. In some cases, students may be unable to mentally project themselves into scientific careers. Another barrier is that minority students may not recognize the variety of post-secondary institutions that they could attend, perhaps selecting a particular school for reasons other than the learning opportunities they can provide. Finally, there is evidence that minority students have learning styles that conflict with instructional approaches typically utilized in college courses. Strategies for increasing the proportion of minorities entering scientific careers must address all of these areas. Clearly, no single strategy will adequately raise enrollments, suggesting that a concerted effort on multiple fronts is necessary to reduce the inequities.

10:15 **EQUITY AND PER PUPIL EXPENDITURES ACROSS OHIO'S PUBLIC SCHOOL DISTRICTS.** Tod S. Porter, Economics Dept., Youngstown State University, Youngstown, OH 44555.

Over the 1980's, the inequity in the abilities of public school districts to raise money locally increased. There has been a modest increase in the level of inequity in the distribution of assessed value per pupil, and a substantial increase in the level of inequity in the distribution of average income across districts. At the same time, increases in state revenues tended to equalize the revenues available to the districts. The net result was that equity in expenditures

per pupil actually improved in the latter part of the decade when state aid rose quickly, and then again began to worsen at the end of the decade as the growth in state revenues slowed. The level of equity in spending was somewhat worse at the end of the decade than it was at the beginning. However, examining equity in total spending masks more serious problems in the state's poorer schools. Some of the growth in state aid was due to growth in the Disadvantaged Pupil Impact Aid (DPIA) program. The amount of aid distributed by the program is based on the number of students in the district who are part of families receiving benefits from the Aid to Dependent Children (ADC) program. As the number of ADC students rose, so did DPIA revenues. The aid helped poorer districts to maintain spending levels, but the dollars available had to cover the costs of educating a rising percentage of disadvantaged students. Once the revenue from the DPIA program and other categorical programs are removed, the results show a dramatic increase in inequity in revenues over the 1980's.

10:30 WHAT WORKS IN THE EISENHOWER PROGRAM. Pei-Hsing L. Wu and Russell O. Utgard, Consultants, Ohio Board of Regents, 30 E. Broad St., Columbus, OH 43266.

The goals of the Eisenhower Program are to improve pre-college science and mathematics education by strengthening teachers and by improving student performance and understanding. Programs designed to meet these goals have brought positive changes in teachers in terms of their knowledge, strategy, and outlook. For the students, enthusiastically doing science/math, better problem solving was noted. Although the effectiveness of the program relies primarily on a well-planned program of high quality, other elements are important contributors to the success/effectiveness of each program. Some of these elements are: Sincerity of project directors/collaborators toward Eisenhower Program goals and their vigilance during the implementation phase; coordination/cooperation among workshop leaders; resourceful instructors serving as model teacher/learner; all teachers of the same level are trained together on school time; teachers waiting to enroll; supportive colleagues, administrators, parents, and community leaders; follow-up sessions over the school year; hands-ons friendly to all kids; simple, familiar materials used for hands-ons which can be used readily; peer coaching across grade-levels of kids. Exemplary programs will be discussed.

10:45 IMPORTANCE OF ENCOURAGEMENT AND PERSONALITY PERCEPTIONS FOR FEMALE AND MALE HIGH SCHOOL STUDENTS. Claudia Khoury-Bowers, McKinley Senior High School, 2323 17th St. NW, Canton, OH 44708.

A survey was taken of juniors and seniors enrolled in introductory physics. Open-ended questions were asked regarding the role of encouragement in their decision to study physics, self-perceptions of personality, perceptions of personality traits of "successful scientists," and their preferred style of learning. Results indicate gender differences in the importance of encouragement and self-perceptions. Seventy-one percent of females and 44% of males reported positive encouragement from adults and peers. Thirty-three percent of males and 14% of females identified themselves as intelligent. Students share perceptions about traits of scientists. Few females or males expressed self-perceptions parallel to those for scientists. Preferred style of learning was hands-on for females and males.

## TEACHING METHODOLOGY

9:00 A.M., Saturday, May 1, 1993

Cushwa Hall, BO85

Spencer Reames, Presiding

9:00 A PLANT ANATOMY RESEARCH PROJECT AS A MODEL FOR CLASSROOM INSTRUCTION. David J. Stroup, Francis Marion College, Florence, SC 29501 and John L. Frola, Dept. of Biology, The University of Akron, Akron, OH 44325.

A seasonal study of the three morphological forms of *Arisaema atrorubens* (Aiton) Blume, (Jack-in-the-Pulpit) is currently under investigation. Observations of the shoot apex of Jack-in-the-Pulpit are described based on an analysis of the theories on shoot apical organization. Measurements of apical dome height and width were obtained to serve as a basis for classroom discussions concerning the changes in apical organization over a one-year period. A multi-media presentation was prepared for students to make accurate observations and interpretations about shoot apices. During classroom discussion, fundamental anatomical and morphological questions were generated to be used as the basis for independent student laboratory investigations. This project was designed to improve student thinking skills, as well as describe our current understanding of shoot apical development.

9:15 COOPERATIVE LEARNING IN SCIENCE. Theodore L. Miller, Dept. of Chemistry, Ohio Wesleyan University, Delaware, OH 43015.

My main goal during the past three years of teaching chemistry has been to create in my courses a community of learners. This goal emanates out of my view of learning and the successful

development of a demonstration-exploration-discussion format for teaching the General Chemistry course. Overall, I have discovered that a classroom environment that fosters active student participation and creativity facilitates learning chemistry. The changes that I have initiated in my teaching not only invoke active student participation and creativity but radically alter the relationship between the teacher and the learner as well. This paper will briefly review the development of the demonstration-exploration-discussion method and outline the cooperative group exercises that we do in class and lab.

9:30 EARTH PATROL. Teri L. Menoche. Brukner Nature Center, 5995 Horseshoe Bend Rd., Troy, OH 45373.

In 1991, the staff of Brukner Nature Center developed a pilot program entitled "Earth Patrol". Earth Patrol is designed for 1st-6th graders to promote an environmental ethic and awareness of environmental issues. The topics covered included 1st Grade-3-R's (Reduce, Reuse, Recycle). Students discussed the importance of the 3-R's, developed their own ideas on how a particular piece of "trash" could be reused, and created a bird feeder from reusable materials. Second Grade - Decomposition. The role of decomposition was discussed as an introduction into the methods of household composting. Third Grade - Sanitary Landfill. By building a model landfill, the students investigated the pros and cons of this type of solid waste disposal. Fourth Grade - Natural Resources. Classifying waste items by the materials used to make them helped students understand the importance of and conservation of our natural resources. Fifth Grade - Sources of Energy. Through discussions, activities, and experiments, students developed a definition of energy and discussed ways they could save energy. Sixth Grade - Water Quality. Students discussed sources of water pollution, ways to conserve water, and learned to identify aquatic invertebrates. "Earth Patrol" was entirely voluntary and held after school from 2:45-4:00 p.m. During the 1991-1992 school year, this program was presented to grades 1st-3rd in all elementary schools in the Troy School District. Thirty-five percent of all students participated. Once field testing and evaluations are completed in the Troy Schools, the curricula will be printed and distributed to teachers, organizations, and individuals throughout Ohio.

9:45 ELEMENTARY/HIGH SCHOOL FIELD STUDY EXPERIENCES: A COOPERATIVE LEARNING PARTNERSHIP. Bruce H. Smith and Spencer E. Reames, Benjamin Logan Magnet Elementary School, 113 N. Stewart St., Rushsylvania, OH 43347.

During the last two years, the Benjamin Logan Magnet Elementary School and the Benjamin Logan High school have been involved in a cooperative partnership in field studies involving zoology, botany, and ecology. During most of these studies, the high school students assumed the role of teachers and, in some cases, the elementary students have taken that position. The studies engage the students in both field collection and laboratory work. The elementary students have benefited from the exposure to higher level skills and content, as well as developing an appreciation for the fact that their education is a continuum as they sample the experiences that they will have when they enter high school. They also developed a realization that science is a dynamic on-going and exciting enterprise to engage in. The high school students have grown through the opportunity to assume the responsibility for influencing the learning and development of the younger students. Less motivated students have strived to look good in front of the younger students. An excellent rapport was developed between the two groups of students, and the community has responded very favorably.

10:00 TEACHERS WORKING WITH TEACHERS. Spencer Reames, Anne Barefoot, Diane Burnett, Carolyn Farnsworth, Elizabeth Horsch, Anne Holbrook, Doug Leonard, 555 Newell St., Apt. #41, Bellefontaine, OH 43311.

For the second of a three-year funding period by the National Science Foundation, the Association of Presidential Awardees in Science and the National Science Teachers Association will hold four institutes for middle-school science teachers. This one-hour workshop will be conducted by instructors and middle-school science teachers who participated at the Purdue University Institute in 1992. A overview of the three-week institute held at Purdue will be given. Inherent in the discussion will be the evolution of an alternative assessment tool designed by the cooperative efforts of the participants and instructors and which was used for evaluating content and pedagogical growth. This powerful new instrument proves applicable in both middle and high school science classrooms. The workshop will focus on designing and adapting science activities for the middle level, alternative assessment methods, and appropriate teaching strategies. Handouts include classroom activities and samples of alternative assessment instruments.

## SCIENCE EDUCATION

9:00 A.M., Saturday, May 1, 1993

Cushwa Hall, BO80

Ed Kimmey, Presiding



9:00 INFORMATION ENGINEERING: BLENDING ARTIFICIAL INTELLIGENCE WITH INQUIRY LEARNING, Dick L. Lester and Janet L. Peterson, 103 Main St., Bloomington, OH 43106.

By blending the organizational and logical thinking needed to develop artificial intelligence expert systems with inquiry science investigations, science education becomes relevant in today's society. An expert system is a computer system which makes a decision based on logic from answers given to previous questions. With inquiry learning, students discover answers to their questions and reveal new questions to ask by investigating a science concept with hands-on learning. The blending of the technology of artificial intelligence with inquiry learning produces the process of information engineering. As information engineers, students are continuously reflecting on newly acquired information and using this information to generate their expert systems. By using a computer program called a "shell program," the writing of the expert systems becomes simplified. Students require few programming skills. While learning how a machine imitates human thought, students develop a logical method for organizing and processing new information. Information engineering requires the acquisition, reflection, and application of knowledge. This process provides students with a motivating purpose and goal to hands-on science learning. The authors discussed the results of a pilot effort in 1992 with eighth grade physical science students with a project funded by the Martha Holden Jennings Foundation and completed in consultation with the Center for Artificial Intelligence Applications in Dayton, Ohio.

9:15 DEMOCRITUS, FATHER OF THE ATOM: A DRAMATIC MONOLOGUE. Joseph H. Lechner, Mount Vernon Nazarene College, 800 Martinsburg Rd., Mount Vernon, OH 43050.

Democritus (b. 470 BC), the Greek philosopher who originated the concept of atoms, visits the 20th century in this 30-minute dramatic monologue suitable for Grades Five - Adult. Most Greeks thought that substances were continuous; any piece of matter, no matter how small, could always be divided into still-smaller pieces. But Leucippus, Democritus's teacher, thought there had to be this process. Sooner or later, one would obtain a piece so tiny that it couldn't possibly be cut again. Democritus called that piece *atomos* (Greek for *indivisible*). The ancients believed that all substances were mixtures of a few simpler elements such as water, air, fire, or earth. Democritus thought that each element was made of a different kind of atom: Fire was made of star-shaped atoms with sharp points; water was made of round, smooth atoms; etc. Democritus's contemporaries thought the idea of atoms was absurd, since anybody could see that a small piece could always be cut into still-smaller pieces. Three centuries later, a Roman teacher, Lucretius (95-55 BC) mentioned atoms in a didactic poem, *On The Nature of Things*. Atoms weren't taken seriously again until John Dalton wrote about them in his chemistry text published in 1808. Dalton became world-famous for his atomic theory, which was well supported by painstaking laboratory measurements. In hindsight, Democritus realized that Dalton received the credit because he obtained experimental evidence for the existence of atoms. In contrast, Greek philosophers rarely experimented because they disdained manual labor.

9:45 THE DEVELOPMENT OF A MODEL TO REPRESENT GOAL DOMAINS. K. Waite, R.C. McClendon and P.A. Schutz, Kyle Waite, 5956 State Rd., Wadsworth, OH 44281.

Most current theories that deal with motivational issues discuss the importance of goals and goal setting during the teaching and learning process. The goal of this research was the development of a conceptual model to represent the different types of goal domains that we attempt to attain and maintain. The domains developed are similar to those developed in other models (see Astin & Nichols, 1964; Buhler & Massarik, 1968; Cross & Markus, 1991; Ford & Nichols, 1987; Wicker, Lambert, Richardson & Kahler, 1984; Winell, 1987). However, unlike the other models which have been developed from the theory of the experimenter, these domains were developed from the responses of students. This was done to discover the goal domains, not to impose them. Participants in this study were 348 undergraduates at a large northeastern Ohio open admissions university. The students were asked to answer the question: "Think about all you would like to achieve, obtain, and/or experience during your life. List as many as you can". From the response to this question, ten interdependent goal domains were identified: (1) personal; (2) social; (3) educational; (4) religious; (5) family; (6) occupational; (7) material wealth and recognition; (8) physical comfort; (9) friendship; and (10) travel and adventure. With an interrater reliability of .85, we categorized 98% of the goals stated by students into one of the goal domains. Therefore, the model should provide more ecological validity to the study of the goals than previous models. We will also discuss how the goal domains relate to other issues such as gender difference, age differences, and concept of core goals (Ford, 1992).

10:00 A STATUS REPORT ON STS EDUCATION BY STATE AND REGION. David D. Kumar, Donna F. Berlin, and Erica M. Brownstein, National Center for Science Teaching and Learning, 104 Research Center, 1314 Kinnear Rd., Columbus, OH 43212.

The objective of this study was to determine the implementation status of Science-Technology-Society (STS) education in the United States by state and region. STS Education has been one of the major foci of science education reform efforts and one of the most significant science curriculum developments in the U.S. In order to determine accurately the status of state-implemented (required/recommended/encouraged) STS education in science education and its

surrogates in the U.S., a national telephone survey was conducted. (In addition to STS there are similar society-based science or technology education programs which we call STS-Surrogates.) Information from fifty states was obtained. The findings revealed that eight states required; nine recommended; and twenty encouraged STS education in their science curricula. Two states incorporated STS-Surrogates and three states reported no STS or STS-Surrogate education. Information obtained in this survey will be used in subsequent STS outcome studies and STS implementation model development.

10:15 MATHEMATICS REQUIREMENTS FOR THE UNDERGRADUATE LIFE SCIENCE MAJOR VS. THE REALITY OF USE. Myron L. Morford, Dept. of Mathematics, Edinboro University of PA, Edinboro, PA 16444.

A limited study was conducted of the mathematics requirements for an undergraduate major in the life sciences (biological science) as to the correlation to the mathematics used by the life science professional. Particularly, the curriculums of the State Universities of PA were examined in relation to the mathematics requirements for majors in the life sciences. The curriculums at Michigan State University (MSU) and University of Kentucky (UK) were analyzed in a similar fashion. Since both universities serve as regional research centers in the life sciences offering a Ph.D. in the various life science areas, the researchers were considered as being representative of life science professionals. The statistics of mathematics requirements reveal that the majority of PA universities require at least two mathematics courses (most commonly a lower level course in analysis and a lower division course in statistics) for the majors as identified. At both MSU and UK a similar pattern was found. Within the scope of the study, it was determined from data gathered by questionnaires administered to a sample of life scientists at MSU and UK, that the undergraduate mathematics requirements revealed only a small relationship to the mathematics used by these researchers. Areas of use were: 1.) testing of significance of experimental results—parametric and nonparametric; 2.) data analysis procedures employing graphical analysis techniques using a computer modeling program; and 3.) spatial geometric analysis of various system models. It was determined that these areas of applied mathematics had frequently been self-taught or learned on a 'need-to-know' basis from another scientist. No conclusions have been reached from this limited study but questions of the currency of the undergraduate mathematics requirements do seem appropriate.

10:30 CURRENT TECHNOLOGY FOR CURRENT TEACHERS, Arthur E. Stormer, Benjamin Logan High School, 6609 SR 47E, Bellefontaine, OH 43311.

I visited 16 local businesses and industries to observe the use of chemistry, technology, and computers in the 'real' world with the support of a Battelle Staff Development Grant. Examples of how instrumentation and techniques are different from the academic environment will be discussed. Use of electronic data acquisition/manipulation and information access in industry is prevalent. Its introduction into schools is imperative. Examples of how to do this will be offered.

10:45 OTHER WINNERS OF BATTELLE AWARDS FOR PROFESSIONAL DEVELOPMENT WILL COMPARE AND CONTRAST THEIR EXPERIENCES WITH THOSE OF MR. STORMER. Participants will include Ms. Diana L. Ault, Mathematics Teacher, Elmwood HS, and representatives from Volney Rogers Jr. HS and Philo HS.

## SCIENCE EDUCATION - BUSINESS MEETING

1:30 P.M., Saturday, May 1, 1993

Cushwa Hall B031

Connie S. Hubbard, Presiding

## TRENDS IN SCIENCE EDUCATION: MODEL CURRICULUM, PARTNERSHIPS, & PROPOSAL DEVELOPMENT

2:00 P.M., Saturday, May 1, 1993

Cushwa Hall B031

Connie S. Hubbard, Presiding

2:00 DEVELOPMENT OF THE OHIO SCIENCE MODEL CURRICULUM FRAMEWORK. Spencer E. Reames, Richard Benz, Cliff Schrader, and Phil Roskos, 555 Newell St., Apt. #41, Bellefontaine, OH 43311.

An advisory committee made up of individuals representing teachers, administrators, parents, industry, universities, and professional societies, along with the staff from The Ohio Department

of Education, is developing the science model curriculum framework. The model will serve as the basis for the development of the science curriculum within each school district. A historical perspective, timeline, and ideas, such as constructivism influencing the model will be described. The current draft of the goals and outcomes, as well as the framework, will be distributed for comment. The panel will be comprised of advisory committee members.

3:00 VIP - VOLUNTEERS IN PARTNERSHIP. Jane Hazen and Connie S. Hubbard, Stark County Local Schools, Edgefield Annex, 2100 38th St., NW, Canton, OH 44709.

Come and learn about a partnership program involving the professionals in science and science-related careers, and the science, math, and technology teachers of Stark County. Learn about projects, networking, funding, and their involvement with the Triangle Coalition for Science and Technology Education.

3:15 PARTNERSHIPS IN SUMMIT COUNTY. Cliff Schrader, Summit County Local Schools, Science Supervisor, 420 Washington Ave., Cuyahoga Falls, OH 44221.

I will describe a collaborative project involving business, industry, university, and professional organizations producing an all day in-service science workshop for 150 teachers. The program included four sets of concurrent "hands-on" sessions developed respectively for primary (K-3), upper elementary (4-6), middle school, and high school teachers. Each teacher received handouts and between \$50-\$150 worth of materials.

3:30 PARTNERSHIP FOR AMERICA'S FUTURE. Nicholas D. Frankovits, 5168 Topaz Dr., Hudson, OH 44236.

Mr. Frankovits is the Executive Director of Partnership for America's Future, a non-profit organization which has formed a mutually beneficial partnership between business and education. Partnership provides students with "real world" problems from business and industry. Thousands of Ohio students have joined in this exciting educational experience. This project is for all types of students - from handicapped and gifted, to the college-bound and vocational student. Mr. Frankovits will explain how you and your students can become involved.

3:45 TEACHING ENGINEERING AND SCIENCE TO ELEMENTARY SCHOOL CHILDREN - A PARTNERSHIP APPROACH. Paul C. Lam, Dept. of Mechanical Engineering, The University of Akron, Akron OH 44325-3903.

This abstract describes a partnership approach between American Society of Mechanical Engineering (ASME) students and elementary school teachers in teaching engineering and science to children in fourth through sixth grades. A "World In Motion" (WIM) teaching material was used to help improve engineering and science education. Its objectives are to promote engineering and science literacy, to emphasize cooperative learning, and to provide opportunities to develop problem-solving skills. This is achieved by implementing design teams which simulate engineering roles in industry. Members of The University of Akron ASME student chapter participate in classroom visits to assist with this program. They serve as a resource for teachers. Before the class visitation, teachers and engineering students attended a "World In Motion" workshop which introduces cooperative learning strategies through the use of design teams. The WIM program was implemented in the Akron and Canton City School Systems in the spring of 1992. Approximately, twenty elementary school teachers have completed the WIM teacher-directed learning cards. Their experiences have resulted in a favorable review of the "World In Motion" program.

4:00 BASIC GRANT PROPOSAL WRITING FOR SCIENCE TEACHERS. Diana M. Hunn, University of Dayton, Dept. of Teacher Education, Chaminade 205, Dayton, OH 45469-0525.

Becoming aware of basic grant proposal writing will enable any teacher to practice the skills outlined, discussed, and critiqued in this paper. Most importantly, finding extra money enables teachers to expand the curriculums, secure needed equipment, and enhance their own professional growth. In many cases, classroom practitioners have been reluctant to seek information on proposal writing because the task appears to be far beyond their capabilities and the time available. However, this is a problem which can be solved. In particular, there are numerous funding opportunities at the local, state, and national levels for science teachers who want to conduct special projects in their elementary or secondary classrooms. Essential components of successful grant proposals include the needs assessment, abstract, objectives, procedures, budget, time frame, evaluation, dissemination, and follow-up. Hints for brainstorming project ideas, working within local school systems, telephoning for resources, finding alternative support, and locating funding agencies are also helpful to the novice. There are indications that many teachers do not have grant proposal writing experience even though guidelines can be readily understood and followed by any beginner. This paper will be an initial step toward filling the gap between need and action. Grants provide opportunities that all science education practitioners should seek in order to improve teaching and learning.

## JUNIOR ACADEMY PAPER PRESENTATIONS FIRST CONCURRENT SESSION

9:00 A.M., Saturday, May 1, 1993

Cushwa Hall 1011

Brian R. Dulin, Presiding

9:00 THE EFFECTS OF PAIN KILLERS ON DROSOPHILA. Amanda J. Schrader. 1973 Gainsborough, Cincinnati, OH 45230.

*Drosophila*, commonly known as the fruit fly, has been used as a predictor of chemicals and substances that may cause birth defects in mammals. Aspirin had been tested with positive results prior to this experiment, which is what prompted my hypothesis and experimental design. I hypothesized that Tylenol and Ibuprofen would result in birth defects that were similar. In this experiment, Tylenol, Aspirin, and Ibuprofen at dosages of 20mg, 30mg, and 40mg per vial, plus a control were tested. Each solute was mixed in the universal solvent, water, at a concentration of 10mg/ml; mixed with the media and then provided to the flies. After the mating and laying period, adult flies were removed and the incubation period began. As the new flies emerged from the experimental media, they were counted and classified. My results showed each chemical caused birth defects. Ibuprofen caused birth defects of wing notches and was deadly in higher dosages. Tylenol caused birth defects in bristles of the thorax and wing notches; also, there was an increase in the number of small flies. Aspirin showed birth defects primarily in the bristles of the thorax. Future experiments should be done to study possible birth defects caused by these chemicals.

9:15 SEPARATING POLLUTING IMPURITIES FROM COAL. Lesley J. Rymer, Rt. 1 Box 194, Little Hocking, OH 45742.

Coal is a plentiful energy source in the U.S., but one which requires significant treatment to remove materials which are harmful to the environment. Recent research has shown that ash, primarily due to iron and other metals, can be removed from some Ohio coals by fine grinding and washing with citric acid. In some samples, the ash level was reduced by more than fifty percent with this treatment. Citrates used to sequester metals in this manner have been reported to lower toxicity in aquatic systems. In addition to the removal of metals, the use of the citric acid in these experiments gave a cleaner separation, so less of the fine ground coal was lost in the sludge. These experiments illustrate the potential some additives may have on new processes to refine high ash coals.

9:30 DREISSINA POLYMORPHA. Holly B. Claus, 5357 Mill St., North Robinson, OH 44856.

*Dreissena polymorpha* attach themselves to anything non-toxic and have been a problem since their invasion in Lake St. Claire in 1986. Reproduction is rapid the first ten years in a new area because of the high quantity of food; then there is a sudden drop because of the lack of food. Researchers expect them to spread north and south somewhat, but mainly east and west. They would also cause their problems there by fouling water, clogging intake pipes, colonizing in boat motors, removing excess amounts of algae and plankton, clarifying water, and possibly harming fish. Stopping the *Dreissena polymorpha* could be impossible lake-wide but in water intake lines it is not. Methods of flushing with hot water, chlorination, molluscides, screens, sand filters, and potassium are being tested. Some researchers are studying what might stop them from colonizing but not cause any ecological problems. My experiment showed that ammonia was toxic to the *Dreissena polymorpha* and that the time it took to kill them was in direct relation to the potency of the material. When the ammonia content was decreased, it took longer for the process to occur. With all the results graphed and recorded, the results showed that the potency of material is in direct relationship with water and that a lower percentage of ammonia meant a longer exposure time. An industry could use this method to control the *Dreissena polymorpha* plus use the water in their cooling system.

9:45 THE EFFECT OF TETRACYCLINE ON THE GROWTH OF CRAYFISH. Michael A. Kanatas, 2758 Kent Rd., Columbus, OH 43221.

For over thirty years, the beef, poultry, and pork industries have been adding tetracycline and other antibiotics to their animal feed. The goal is to accelerate animal growth, because larger animals bring a higher profit at the market. The purpose of this project was to determine if tetracycline added to the water of *Procambarus clarkii* (red swamp crayfish) would increase their growth. Would it be advantageous to farm a larger crayfish that could be used for human consumption or animal feed? Two groups of crayfish (larger red and smaller feeder) were separated into five tanks, each tank containing ten specimens. Groups consisted of one control tank and four experimental tanks. Measured amounts of tetracycline (75mg, 150mg, 250mg, 500mg) were added two times a week in each tank over a period of ten weeks. Once a week, the larger crayfish were weighed, while the smaller were measured. Average weekly weight and

length gains were recorded. There was a cut-off point where too much tetracycline was detrimental to growth. Crayfish became lethargic and had smaller appetites with doses of 250mg and 500mg. Largest growth was found in the tank containing 150mg of the antibiotic. This group also seemed to be the healthiest with no crayfish dying. Data indicates it would be advantageous to farm newly hatched crayfish with developing softer shells. However, is not advisable add tetracycline to already developed crayfish, since there was no increase in their size.

10:00 RADIATING SCIENCE. Brian R. Dulin, 207 Reo Dr., Chillicothe, OH 45601.

Isotopes of elements undergo radioactive decay at varying rates as indicated by the half-life of the material. The half-lives of three sources,  $^{196}\text{In}$ ,  $^{92}\text{V}$ , and "unknown" dust wiped from a television screen were evaluated. The rate of decay of radioactive isotopes follow the exponential relationship —  $A(t) = A_0 e^{-\lambda t}$  where  $A$  is the activity of the sample,  $\lambda$  is the decay constant, and  $t$  is the expired time since determination of  $A_0$ . The radioactive materials were either created by neutron activation of normally stable isotopes or obtained by taking a wipe of the "dust" from a television screen. Activity data was obtained utilizing a Geiger-Muller instrument with dead time correction. Results were plotted on semi-log paper after background correction and the half-lives were calculated to be 55.4 minutes for the  $^{196}\text{In}$ , 3.76 minutes for the  $^{92}\text{V}$ , and 37.6 minutes for the "dust" on the screen. The dust result was found to be due to the electrostatic attraction of the radioactive daughters of decay of radon. This gas seeps into buildings from the ground and sources.

10:15 THE EFFECTS OF ULTRA-HIGH CONCENTRATIONS OF ATMOSPHERIC CARBON DIOXIDE ON THE GROWTH OF CORN. Gregory J. Lohman, 1722 Boston Rd., Hinckley, OH 44233.

The enhanced greenhouse effect theory raises interesting questions about the response of plants to increased levels of atmospheric carbon dioxide. Changes in food crops could have potentially serious consequences for Earth's inhabitants. This experiment hypothesized that ultra-high levels of atmospheric  $\text{CO}_2$  would produce beneficial effects on the growth and development of corn. Four "greenhouses" (one control and three experimental) were constructed from fluorescent grow-light fixtures and plastic drop cloths, which enclosed trays of corn seedlings. Plastic trash bags of a known volume were used to store "atmospheres" of ultra-high concentrations of  $\text{CO}_2$ . The correct percentage of  $\text{CO}_2$  for each atmosphere was produced by the sublimation of a calculated weight in grams of dry ice, arrived at by means of the Ideal Gas Law. The dry ice was placed in a trash bag which was then inflated using a vacuum cleaner and, subsequently, completely sealed. Tubing allowed the gas to flow from the storage bags into the greenhouses and circulate around the plants. Plant height and weight were measured at intervals and the average linear density (weight/height) was calculated. It was found that corn grown in ultra-high concentrations of  $\text{CO}_2$  grew taller and matured faster than the control. While corn is not normally grown in greenhouses, these results suggest practical applications for hothouse crops. The results also suggest that field crops would benefit from increased atmospheric  $\text{CO}_2$ .

10:30 WOOD AS A RENEWABLE ENERGY RESOURCE. Roberta M. Whalen, 350 S. Fairfield Rd., Bellbrook, OH 45305.

This paper examines the feasibility of planting fast-growing trees to be harvested as fuel wood. Three major factors which determine the amount of heat generated by burning wood have been identified: moisture content, the method of burning, and the type of wood used. The chemical processes whereby trees store solar energy and release it during combustion are examined. Since the glucose produced by photosynthesis is converted within the tree to the various components of wood, it is understood that the differences between different varieties of trees are primarily structural; chemically they are all about the same. Since heat is produced as a result of the chemicals' breaking up of the compounds within the wood, the amount of heat produced should be directly proportional to the amount of mass available—that is, the weight of the wood. In order to test my hypothesis, I designed a little furnace in which to burn small amounts of wood and measure the heat by means of the temperature change in a container of water heated by the fire. I utilized kiln dried wood in order to control the moisture content of the wood. The results of my experiment supported my hypothesis. Although the amount of heat generated by the same volume of different types of wood varies considerably, the amount of heat generated by the same weight of these different types is nearly constant. This research should be valuable in choosing trees for establishing a fuel wood plantation.

10:45 THE RELATIVE TOXIC EFFECTS OF PETROLEUM PRODUCTS ON THE BACTERIAL GROWTH AND ACTIVITY IN LAKE CHAUTAUQUA. Suzanne M. Torontai, 2199 Barrington Rd., University Hts., OH 44118.

My hypothesis was 25 ppm is the lowest concentration at which motor oil will be toxic to the bacterial growth and activity in Lake Chautauqua. The following were the three methods I used to test my hypothesis: spread plate designated concentrations of gasoline, diesel fuel, and motor oil. Spectrometer and spread plate readings of designated dilutions of petroleum products grown in erlenmeyer flasks. The third experiment was MPN done in the designated dishes. I observed

that bacteria feed on the gasoline and diesel fuel, but the oil was toxic to the growth of the bacteria. In addition, I made gram stained slides of the bacteria and identified some of them also. Overall 25 ppm is toxic to the bacterial growth and activity in Lake Chautauqua.

## JUNIOR ACADEMY PAPER PRESENTATIONS SECOND CONCURRENT SESSION

9:00 A.M., Saturday, May 1, 1993

Cushwa Hall 1012

Emily Roberts, Presiding

9:00 AGGRESSION: THE EMOTIONAL ENVIRONMENT. Angela C. Posey, 4031 Thompson St., Carrollton, OH 44615.

This project was designed to demonstrate one of the causes of aggression. Experimentation took place in four, two-week parts. The first section included two male immature *Mus musculus*. One underwent positive physical stimulation, Subject B, while the other did not. Results included Subject A becoming dominant, and Subject B was subjected to abnormal behaviors. Those included were unusual nipping and licking, having food stolen, being slept upon, and being chased. Subject B also developed a large bump on his back from Subject A. Subject A became more vocal and grew five-tenths of an ounce more than Subject B. When the procedure was repeated, the results were almost identical; the only exception being that the subjects were reversed. Subject A received the stimulation, while Subject B did not. The only change was that Subject B became six grams larger than Subject A. Also, Subject A incurred a large bald spot from Subject B biting him. Subject B even bit the finger of the researcher. The third step mirrored the first two, but neither *Mus musculus* was held, and new subjects were obtained. The mass difference was thirty-five thousandths of a gram, while the length difference was two millimeters. Throughout this phase and the next, neither *Mus musculus* was aggressive. In the next phase, both subjects were held. The mass difference was thirty-five thousandths of a gram. The length difference was two millimeters.

9:15 HEARING FROM THOSE WHO RECEIVE IT. Neala Rafizadeh, 38 W. Monteray Rd., Dayton, OH 45419.

In the traditional process of education, it is the views of the teachers and educators that are primarily heard. Rarely the voices of the students make any impressions on designs and schemes that in aggregate become the education system. The purpose of this paper is to share the insights and opinions of one student on approaches currently common in propagation of science in high school teachings. A student originated exploration of science taught in high school will reveal its successes and failures from a student's perspective. Aspects that would aid in greater communication of scientific knowledge and promote a higher level of interdisciplinary studies will be highlighted.

9:30 STEREOTYPING. Jennifer L. Dunfee, P.O. Box 643, Proctorville, OH 45669.

Questionnaires were distributed to 596 students in grades 1-12 in the Fairland School District. There were three different questionnaires. The first questionnaire was distributed in grades 1-5. Thirty-eight percent of the students in grades 1-5 stereotyped. The second questionnaire was distributed in grades 6-8. Twenty-four percent of the students in grades 6-8 stereotyped. The last questionnaire was distributed in grades 9-12. Twenty-two percent of the students in grades 9-12 stereotyped. The results of my experiment showed that as a person gets older they are less prone to stereotype. This year distribution of a questionnaire will be distributed to adults in the age group 20-90. The results of this experiment should be that stereotyping decreases as a person grows older.

9:45 EXPOSING SURFACES WHERE BACTERIA ACCUMULATE. Farah D. Salim, 6898 Bowie Rd., Cambridge, OH 43725.

The purpose of this experiment was to expose areas where large quantities of bacteria are found. It was hypothesized that the number of colonies would range from ten to one thousand. Fifteen areas were tested. Each was swabbed, then brushed onto the agar in the petri dish. The bacteria was then allowed to multiply at a steady temperature for twenty-four hours. The colonies were counted and preserved in a refrigerator for any future observations. The hypothesis was disproved in most cases. Areas tested that were in a public restroom facility were generally found to have the largest number of bacterial colonies. The restroom sink area had the largest number of bacteria with eight hundred and thirty-five colonies. The doorknob of room had the smallest amount with only seventeen colonies. The results tell us that, generally, public facilities have the largest quantities of bacteria present. Hands have the second largest number of bacteria. This experiment is important to the general population because they may strive to reach a personal level of cleanliness. Also, the results in this experiment and those like it will encourage industries to provide new and better products that reduce bacteria and furnish clean, safe environments.

10:00 ANALYSIS OF THE RETINOBLASTOMA GENE PRODUCT THROUGH IMMUNOHISTOCHEMISTRY IN MOUSE LUNG TUMOR SECTIONS AND CELL LINES DERIVED FROM CHEMICALLY-INDUCED MOUSE LUNG TUMORS. Amy L. Creekmore, 2653 119th St., Toledo, OH 43611.

The retinoblastoma gene is a tumor suppressor gene which is linked to the formation of cancer. This gene codes for a protein that regulates progression through the G1 phase of the cell cycle. Immunohistochemistry was performed to analyze this protein in 16 frozen mouse lung tumor sections, and 6 cell lines derived from chemically-induced mouse lung tumors. Results from the cell lines were compared with previous research. This comparison revealed that despite the mutations of the P1b protein, 5 of the 6 cell lines still stained positive for the protein. The result also disclosed that 2 of the frozen sections stained positive, and 4 negative. The remaining ten sections contained both negative and positive staining.

10:15 EFFECT OF SODIUM HYPOCHLORITE ON POULTRY MICROBES. Amy A. Caudy, 5797 Plantation Rd., Sunbury, OH 43074.

The effect of sodium hypochlorite (commonly known as bleach) on microbial growth resulting from commercially processed chicken was determined. Bacterial contamination of processed chicken is a well documented cause of food poisoning, and many measures are being considered by the poultry industry to reduce contamination. The hypothesis was: chicken treated with a sodium hypochlorite solution would exhibit less microbial growth than untreated chicken. Experimental procedure involved swabbing 4 cm<sup>2</sup> of skin on a drumstick and inoculating selenite broth with the swab. The drumstick was immersed in a sodium hypochlorite solution for one minute and swabbed again. This second swab was used to inoculate another tube of selenite broth. The inoculated broth was incubated approximately 14 hours. 0.05 mL of inoculant from each tube was spread on petri dishes containing MacConkey agar. After 24 hours incubation the colonies were counted. Concentrations of sodium hypochlorite used were 2,100 ppm, 525 ppm, 263 ppm, and 67 ppm. Microbial growth was eliminated in the majority of chicken exposed to 2,100 ppm and 525 ppm concentrations. Some control resulted from the use of other concentrations. Inspection with a microscope revealed bacilli and cocci bacterial forms.

10:30 VERIFICATION OF THE CONSTRUCT AND EXPRESSION IN YEAST OF THE PLASMID pBL 100. Emily J. Roberts, 4947 County RD 5, Rushsylvania, OH 43347.

*Bacillus thuringiensis* is a bacterium which produces an insecticidal crystal protein during its sporulation process. This crystal, the delta-endotoxin, is toxic to many species of Lepidoptera which are serious crop pests. *B. thuringiensis* is an aerobe and does not mature well in oxygen depleted conditions. The yeast *Saccharomyces cerevisiae* can function as either an aerobe or an anaerobe. For this reason, it is thought that this yeast, in fermentation processes, may produce a greater amount of the delta-endotoxin than the bacteria. A plasmid has been constructed which contains the endotoxin gene. However, it has not been fully demonstrated that the plasmid contains this gene. The object of this present research is to establish whether or not the plasmid has been successfully constructed and to determine if this gene is expressed in yeast. A DNA probe was constructed last year, but too much background material was obtained, thus prohibiting accurate results. This paper will discuss the results of analysis with a smaller probe and the bioassay results.

10:45 THE EFFECTS OF ULTRAVIOLET LIGHT ON BACTERIAL DNA MUTATION REPAIR SYSTEMS. Kristi L. Ohler, 17312 CR 85, Belle Center, OH 43310.

As more ultraviolet light is permitted to reach the Earth's surface, because of the ozone depletion, more mutation in cells will result. This paper will discuss the effect of ultraviolet light on normal cells and mutagenic repair deficient cells, as well as the effects of different times and ultraviolet light exposures to different strains of *Escherichia coli*. An 18-24 hour culture was grown in Luria broth and on Nutrient Agar plates. Dilutions of overnight cells were made to 0.6 Optical Density at 600 Nm, were spread on plates. The dilutions were then exposed to ultraviolet light and/or light for selected intervals, and then allowed to grow. The work indicates that a 30-second interval was the optimal time exposure for the study. The work also indicates that photo reactivation occurs in wild type strains.

## 1:30 - 2:30 POSTER BREAK

## JUNIOR ACADEMY PAPER PRESENTATIONS

2:45 P.M., Saturday, May 1, 1993

Cushwa Hall 1011

Bill Hope, Presiding

2:45 COMPARISON STUDY OF VISIBLE STEREO VERSUS INFRARED STEREO IMAGERY. William A. Hope, 11820 W. Hall Rd., Laura, OH 45337.

The purpose of this project was to 1.) compare regular GOES visible 3-D stereo and GOES infrared 3-D stereo images; 2.) find the cloud height using the 3-D imagery, the parallax shift, and mathematical ratio of the height; and 3.) determine the potential opportunities of continuous infrared stereo versus visible stereo. The conclusion of this project is that this new research of stereo measurement will become automatic for the study of hurricanes and severe storms. This new application will help on the GOES I-M satellites by giving better horizontal resolution of the infrared channel over sampling of the visible data. Operational stereo data processing is also included in the 1992 National Weather Service operational plans for the first time. This technique could provide a useful forecasting tool by augmenting observational data sets of severe thunderstorms and hurricanes. Another potential real-time application involves the vertical analysis of wind fields obtained by tracking clouds at stereo analyzed heights. This will help pilots and the FAA to give better ways to avoid flying through the storm or clouds because they will know the height of the clouds and of the severe storm patterns.

3:00 TEMPERATURE'S EFFECT ON ROCKET ENGINE PERFORMANCE. David R. Fiske, 170 Church Hill Dr., Findlay, OH 45840.

In the experiment, temperature extremes were used to test rocket engine performance in relation to launch temperature. The greatest possible extremes were used so that the difference would be detectable even if it were very small. The hypothesis states that there is a relationship between the launch temperature and the distance traveled of a rocket engine. A small enclosed area designed specifically for the experiment was used. The rocket engines were placed in a specially made steel arm, which was counter balanced. The chamber was cooled by packing frozen CO<sub>2</sub> into coffee cans, which were sunk in the box. The box was heated using two heaters that were attached to fans, which were run before hot and cold tests, to eliminate hot/cold spots. The engines were ignited using a standard electronic ignition system. Revolutions were counted by a photo counter. The temperature was monitored by a digital thermometer to the nearest tenth of a degree, and the engines were stored in a desiccator. The possibility of fuel differences having an effect was eliminated by taking pre-launch and post-launch masses. I found that there was no significant difference either in fuel use or in distance traveled due to fuel use. I found that the general slope of the graphed information proved my hypothesis correct.

3:15 DESIGNING AND IMPLEMENTING A 4-D GRAPHICS LANGUAGE. Jonobie D. Baker, 5525 Ailyn Road, Mantua, OH 44255.

The purpose of this project was to design and implement a 4-D graphics language that provides a LOGO-like extension of LOGO's 2-D turtle graphics system to a 4-D HYPERBIRD graphics system. The system allows a user to fly an interactive 4-D HYPERBIRD in 4-D Euclidean space, open a 3-D window into that space, and see the flight of the HYPERBIRD that is in that window on a computer monitor. The system is written in the computer language "C" and uses X-Windows for the graphics on a DEC station 3100 with 8-plane color graphics. To build the system, the presenter mathematically had to develop the formulas for 4-D motion relative to the HYPERBIRD's current position. The project is a major extension of two earlier projects of the presenter, a 3-D LOGO and a 4-D LOGO written for an Apple IIc in 1990 and 1991. Unfortunately, the Apple IIc hardware was unable to handle the 4-D LOGO interactively. It became clear that by redesigning the entire system, a more efficient and useful HYPERBIRD graphics system could be built. The procedure followed was: 1.) learn "C", X-Windows, and ULTRIX by writing programs on the DEC station 3100; 2.) establish design requirements for the system; 3.) design the data structures; 4.) in the following order: design, code, test, and debug a.) the main command reading loop; b.) the user Services functions; c.) the HYPERBIRD's forward and backward motions; d.) the HYPERBIRD's rotations; and e.) the graphic output functions, where c. and d. initially generated numerical output; 5.) test and debug the entire system; 6.) Generate 4-D images interactively. Construction of the current system started in June, 1991. HYPERBIRD, the 4-D graphics language, currently contains over 4,000 lines of "C" code in 13 files. The system can be used to model 4-D motions, to display images of 4-D objects, to rotate, translate, and scale images created by an interactive flight, and graphically represent functions of four variables.

3:30 ELECTROCHEMICAL DEPOSITION SIMULATED BY GENERALIZED DIFFUSION-LIMITED AGGREGATION. Daniel C. Stevenson, Hudson High School, 2500 Hudson-Aurora Rd., Hudson, OH 44236-2389.

The random-walk based process of diffusion-limited aggregation (DLA) was generalized to allow generation of the varied fractal structures found in nature. The variations included multiple particles diffusing and aggregating, growth inhibiting particles (passivators), and surface growth kinetics based upon a Boltzmann energy distribution. A novel optimization to the DLA algorithm was also implemented. Simulations were programmed in FORTRAN on IBM RS/6000 workstations. Single particle and depleted pool multi-particle DLA model were investigated. Passivators diffuse similarly to active particles but, upon attaching to a growing cluster, inhibit further growth at that site. The critical passivator concentration, above which all growth ceases, was found for

both single and multiple particle two-dimensional models to be 41% to 1%. Models for surface growth kinetics were used to reduce the probability of attachment of a particle with a decreased number of nearest neighbors. As surface growth kinetics became more restrictive, the resulting structure became more compact and ultimately crystalline. The influence on fractal structure of different initial concentrations for a multi-particle model were also investigated. Trends in fractal dimension for all models were analyzed. One natural system, electrochemical deposition of zinc, was investigated to determine the effects of applied voltage, solution molarity, and additives such as saccharin on the growth of zinc metal aggregates. The simulation predicted structures with increasing particle concentration that were consistent with experimentally produced structures for increasing voltage. The fractal dimensions of the zinc deposits were computed from analysis of digitized images.

#### 3:45 RECYCLING FLUORESCENT LIGHT USING PHOTOVOLTAICS.

Venkatesh Satish, 2326 Plum Leaf Ln., Toledo, OH 43614.

The experiment was conducted to determine how effectively indoor fluorescent light could be recaptured by photovoltaic cells, comparing amorphous silicon and crystalline silicon cells, placed in 160 different locations on the walls of a classroom without the influence of outside light. The light intensity in foot-candles, open-circuit voltage, and short circuit current were measured at each point. Also, the maximum power point and its components were determined by placing varying load on the cell. It was determined that under normal conditions of indoor fluorescent lighting, 1.) measurable and usable amounts of power were generated by the cells; 2.) amorphous cells generated more power (4.14 Watts) than crystalline cells (.347 Watts), had a higher conversion efficiency (4.28% vs. 0.35%), and were more cost-effective; 3.) power generated by the solar cells was directly proportional to the light intensity.

#### 4:00 THE FUTURE OF COLONIES IN SPACE. Marvin B. Harris, 4231 East 128 St., Cleveland, OH 44105.

Since 1961, the year of America's first manned foray into space, a more feasible way of sustaining space travel and exploration has been an enigma of man. Merely entering and departing outer space was insufficient to satisfy the inquisitive nature of man. A detailed study of the outer reaches of the atmosphere and deep space is what the pioneering scientist had as a goal. In order to accomplish this goal, there is needed a means of supporting life and equipment for an extended period of time. One of the ways in which this might be accomplished, is the building of "space stations", or colonies. These artificial environments would provide work space, living quarters, refueling stations and, essentially, all that would be needed to make extended space exploration easier. The use of robotics, to facilitate and make work easier and safer, and hydroponics, to provide a more complete diet to safeguard the health of the workers, are two of the more modern techniques that will be used. Several of these artificial environments in one general location to support specific groups would constitute the beginnings of colonies in space. In time, these colonies could be spread along specific routes, and over an increasingly broader area, to become highways and rest stops along the way to deeper space exploration and, perhaps, permanent residence in space.

#### 4:15 GROUND-BASED SIMULATION OF MICROMETEORITE INDUCED ACOUSTIC EVENTS. Jacqueline A. Shuster, Perry High School, Manchester Ave., Perry, OH 44081.

A novel acoustic emission technique for identifying micrometeorite impacts with fiber reinforced composites (FRCs) has been demonstrated. A new amplitude band between 70 - 100 dB clearly distinguishes kinetic impacts from other documented acoustic events known to occur in FRCs, including delamination, matrix cracking and fiber breaking. This acoustic technique may prove useful for characterizing the structural properties of FRCs in a space environment and may ultimately lead to a diagnostic model for predicting the useful life of these high-strength-to-weight ratio materials. A predictive technique of this type would establish an optimum repair or change-out cycle for FRC based structural components prior to catastrophic failure. Testing of an acoustic emission package as part of a 1993 space shuttle payload is recommended to verify these encouraging ground-based simulation results. The experimental approach and results describing the acoustic emission technique will be presented.

## PHYSICAL AND MATHEMATICAL SCIENCES

1:30 P.M., Saturday, May 1, 1993

Cushwa Hall 1012

Warren M. Young, Presiding

#### 1:30 THE TIME DOMAIN DISCRIMINATION OF TIME SERIES. H. Richard Tachia, Division of Business and Economics, Wilberforce University, Wilberforce, OH 45384.

This simulation study examines the error rates associated with the classification of the time series  $Y_N = (y(1), y(2), \dots, y(N))'$  into one of two mutually exclusive classes or groups  $\xi_1$  and  $\xi_2$ . Each class is characterized by a linear stochastic process that  $x_i$  assumed to be covariance stationary and obeys the auto regressive structure with parameter  $\theta_i$  and known order  $p_i$ ,  $i=1,2$ . This characterization will be symbolized by  $AR(p_i)$ . The discriminant function,  $\delta(Y_N; \theta_1, \theta_2)$  is a function of sufficient statistics that contain all the information that is needed for discriminating between  $\xi_1$  and  $\xi_2$ . The estimate of  $\theta_i$  is obtained from the training realization  $X_i = (x(1), x(2), \dots, x(N_i))'$  from  $\xi_i$ ,  $i=1,2$ . The simulation is based on the discrimination between the following pairs of classes:  $AR(1)$  versus  $AR(1)$ ;  $AR(1)$  versus  $AR(2)$ ; and  $AR(2)$  versus  $AR(2)$ . The error rates and J-divergence rates are evaluated for each pair. The study establishes the inverse relationship between these rates and more importantly gives a margin of classification accuracy that is to be expected in practical applications.

#### 1:45 MULTIPARAMETER MATRICES. John Jones, Jr., 2101 Matrena Dr., Dayton, OH 45431.

The main purpose of this work is to treat the problem of similarity of pairs matrices of holomorphic functions of the form  $A(z_1, z_2, \dots, z_s)$ ,  $s \geq 1$ , where  $z_1, z_2, \dots, z_s$  are complex variables. Such matrices arise in the area of mathematical modeling and computer simulation of nonlinear control systems containing parameters. Parallel processing and super-computers are needed to treat the problem of similarity of distributed multiparameter matrices. Necessary conditions and sufficient conditions are established for the existence of a non singular  $P(z_1, z_2, \dots, z_s)$  such that for a given holomorphic  $A(z_1, z_2, \dots, z_s)$  such that  $[P'(z_1, z_2, \dots, z_s)A(z_1, z_2, \dots, z_s)P(z_1, z_2, \dots, z_s)] = B(z_1, z_2, \dots, z_s)$  along with a method of computing such a matrix  $P$  for a given  $B$ .

#### 2:00 OBJECT ORIENTED PROGRAMMING IN OBERON. Sameer Gupta, 3315 Valleston Pky. #108, Toledo, OH 43607.

Object Oriented Programming is the trend of the '90s. Among the various new object oriented languages coming up in the market is Oberon. This is the creation of Martin Reiser and Niklaus Wirth (of Pascal). After a brief overview of the Oberon system and the Oberon language, an example in the language illustrates its modular approach towards programming. The object oriented nature of the language is then described with examples of type extensions (inheritance) and procedure types. This paper gives the overall summary of Oberon, taking into consideration the technical details and giving examples to show how it works. Considering its small size, portability and diversity, Oberon is powerful language but does have a few drawbacks.

#### 2:15 COLUMBUS WAS NO ASTRONOMER. Warren M. Young, Dept. of Physics & Astronomy, Youngstown State University, Youngstown, OH 44555-2001.

If it weren't for mistakes in astronomy and geography, Columbus never would have attempted his voyage of discovery. He ignored Eratosthenes' measurement of the Earth's circumference of 25,000 miles (250 B.C.) and Ptolemy's value of 21,000 miles (100 A.D.), and chose 19,000 miles from a misreading of findings by the Muslim geographer Alfragan. He also imagined that China steno eastward as far as the longitude of Cuba. By these two errors, he reduced his estimated distance to the Orient from its actual value of 12,000 miles to 2,700 miles. Because accurate clocks weren't available in 1497, 15th century navigators could not measure longitude. Columbus had two opportunities when he knew the exact time and could measure his longitude-lunar eclipses during his second and fourth voyages. Both times he calculated his longitude as being far west of his actual site. The first good measurement of the longitude of the New World was made by Amerigo Vespucci, who timed a conjunction of the moon with Mars during his 1499 voyage. The result convinced Vespucci that Columbus had not reached the Orient, but had discovered a new continent. Hearing of Vespucci's discovery, the map-maker, Waldseemuller, named the new land "America".

#### 2:30 PERIOD DETERMINATION AND STARSPOT MODELING OF THE RS CVn STAR HD 8357. T.L. Huard and S.J. Yorka, Dept. of Physics and Astronomy, Denison University, Granville, OH 43023.

B- and V-filter photometric observations of the RS CVn star HD 8357 were obtained using the Phoenix-10 automated photometric telescope located at Whipple Observatory, Mt. Hopkins, AZ. RS CVn stars are stars which exhibit low-level variability ( $\Delta V < 1$  magnitude) due to starspots on their surfaces. Fourier analysis techniques have been used to determine the starspot period for HD 8357. The average period is 12.38 days, but data taken from 1988 through 1990 shows that the period is evolving. This period evolution is used to discuss the spot area on HD 8357 in terms of the one-spot model and the two-spot model.

#### 2:45 AUTO IONIZATION RATES FOR RYDBERG STATES OF $H_2$ . William G. Sturms, Dept. of Physics and Astronomy, Youngstown State University, Youngstown, OH 44555-3616.

A calculation of lifetimes for highly-excited states of molecular hydrogen ( $H_2$ ) will be presented, which follows the calculation of Eytler<sup>1</sup>, but is applied to a spectroscopically unexplored region in the spectrum of  $H_2$ . Values for these lifetimes are essential for an experiment using a CO<sub>2</sub> laser



to excite a fast molecular beam. Similar studies using a CO<sub>2</sub> laser have produced interesting experimental values for physical constants of the molecular ion (H<sub>2</sub><sup>+</sup>).<sup>2,3</sup> The calculation is performed within the framework of the polarization model making use of one characteristic of highly-excited Rydberg states; Rydberg states have very little core penetration. Nevertheless, spectroscopic methods applied to Rydberg states of the molecule, coupled with the polarization model, can be used to measure molecular properties of the molecular ion which are otherwise difficult to measure with traditional spectroscopic methods applied directly to the ion. The states of interest in the calculation have principal quantum number  $n = 16$  or  $n = 17$  and vibrational quantum number  $V = 1$ . These are found to have lifetimes up to a few hundred nanoseconds depending on the angular momentum of the particular state. The longest lifetimes occur for the states of highest angular momentum. An anticipated spectrum is generated based on these lifetimes. 1. Phys. Rev. A 34, 2881 (1986). 2. Phys. Rev. A 42, 6950 (1990). 3. Phys. Rev. A 44, 3032 (1991).

**3:00 NUCLEAR OVERHAUSER EFFECT AND TWO-DIMENSIONAL NMR STUDIES OF LIGAND ENZYME CONFORMATIONS.** Sajith A. Jayasinghe and Theodore L. Miller, Dept. of Chemistry, Ohio Wesleyan University, Delaware, OH 43015.

In recent times, NMR spectroscopy has increasingly become the method of choice in studying ligand enzyme interactions. Transferred nuclear overhauser effect (TRNOE) spectroscopy can be used to determine relative distances between protons in a ligand bound to an enzyme. In this paper, the interaction of 5'-adenosine monophosphate with yeast alcohol dehydrogenase and the interaction of 5'-uridine monophosphate with ribonuclease will be discussed. In both of these cases, the ligand may exist in either the syn or the anti-conformation around the glycosidic linkage, and the conformation of the ligand bound to the enzyme can be determined using the TRNOE method.

**3:15 ENTHALPIES DIFFERENCES BETWEEN LIQUID WATER STRUCTURES BY DECONVOLUTING FTIR SPECTRA.** Howard D. Mettee and Mahmood N. Nily, Dept. of Chemistry, Youngstown State University, Youngstown, OH 44555.

Three forms of hydrogen bonded water molecules may be distinguished from the infrared absorption spectrum of the fundamental OH stretching region at 3,400 cm<sup>-1</sup> of liquid water. These overlapping bands may be resolved numerically by selecting component bands of mixed Gaussian-Lorentzian character, and then studying the temperature dependence of their areas. Using totally internally reflecting cell crystals of both germanium, and zinc selenide, and both H<sub>2</sub>O and D<sub>2</sub>O liquids, the enthalpy differences between these forms were determined. For the equilibria  $A \rightleftharpoons B$ ,  $B \rightleftharpoons C$ , and  $A \rightleftharpoons C$ ,  $\Delta H$  values of 0.98, 0.62, and 1.57 kcal/mol were found for H<sub>2</sub>O, while the corresponding values for D<sub>2</sub>O were 1.37, 0.68, and 2.07, kcal/mol, respectively. For both liquids, Hess's Law is obeyed, within experimental error, and the enthalpy values are independent of the cell crystal.

**3:30 SMECTIC LAYERING IN CONFINED LIQUID CRYSTALS.** G.P. Crawford, R. Ondris-Crawford, S. Zumer and J.W. Doane. Liquid Crystal Institute, Kent State University, Kent, OH 44242-0001.

The molecular orientational ordering and dynamics at a solid-liquid interface approaching the smectic A-isotropic (A-I) transition from above are studied with deuterium nuclear magnetic resonance. The deuterated liquid crystal material dodecylcyanobiphenyl (12CB-*od*) is filled into the cylindrical channels of Anopore membranes (dia. = 200 nm). The channel walls are chemically treated with an aliphatic acid (C<sub>n</sub>H<sub>2n+1</sub>-COOH) for various carbon numbers (n=9, 11 and 15). Two discontinuous steps in the averaged quadrupole splitting frequency  $\langle \delta \nu \rangle$  are observed as the A-I transition temperature is approached from above. We analyze these anomalies in terms of the appearance of layer-by-layer smectic ordering. A phenomenological description is developed. The orientational order parameter in the smectic layer, as well as the exchange rate between the highly ordered surface layer and disordered bulk, are measured. A downward shift in the temperatures when layering appears is observed as the chain length of the aliphatic acid surfactant is decreased. We attribute this to the weakening of the interfacial coupling. Supported by NSF ALCOM DMR89-20147 and NSF DMR90-440635. \*Permanent address: University of Ljubljana, Jandranska 19, 6100 Ljubljana, Slovenia.

**3:45 CONFIGURATION OF CYLINDRICALLY CONFINED LIQUID CRYSTAL UPON APPROACHING THE SMECTIC A PHASE.** R.J. Ondris-Crawford, G.P. Crawford, M. Vilfan\*, I. Vilfan\*, S. Zumer\*, and J.W. Doane. Liquid Crystal Institute, Kent State University, Kent, OH 44242-0001.

The structure of liquid crystal is studied upon cooling from the nematic to the smectic A phase in submicrometer cylindrical cavities using deuterium nuclear magnetic resonance (<sup>2</sup>H-NMR). The <sup>2</sup>H-NMR lineshapes indicate an escaped-radial configuration influenced by the increase in the bend-to-splay elastic constant ratio ( $K_{33}/K_{11}$ ). Theoretical fits to these lineshapes are calculated using Frank elastic theory. We extrapolate the dimensionless surface parameter,  $\sigma = RW_0/K_{11} + K_{24}/K_{11} - 1$ , which yields information on the molecular anchoring strength,  $W_0$  and the saddle-splay elastic constant,  $K_{24}$ . Supported by NSF ALCOM DMR89-20147 and NSF DMR90-

440636. \*Permanent address: University of Ljubljana, Jandranska 19, 6100 Ljubljana, Slovenia.

**4:00 OPTICAL INVESTIGATION ON LIQUID CRYSTAL AND LIQUID CRYSTAL/POLYMER NETWORK SYSTEMS CONFINED TO SMALL CAPILLARY TUBES.** A. Scharkowski, G.P. Crawford, S. Zumer, and J.W. Doane, Liquid Crystal Institute, Kent State University, Kent, OH 44242.

We studied various liquid crystal and liquid crystal/polymer network systems in supramicrometer glass capillary tubes using optical polarizing microscopy. A surface treatment that provides strong, perpendicular anchoring of the liquid crystal molecules at the inner capillary surface leads for nematic LC to the stable escaped-radial director configuration. This configuration is very sensitive to the bulk elastic constant ratio  $K_{33}/K_{11}$  of nematic LC, an important parameter for LC devices. We developed a convenient method for the determination of  $K_{33}/K_{11}$ , based on the optical birefringence pattern investigation of this configuration. By dissolving a small percentage of photoactive diacrylate monomers into the LC and UV-polymerizing the solution, the escaped radial configuration can be transferred to the growing network during the polymerization process. The final product is an oriented polymer network in a LC matrix with new physical properties. First studies indicate a highly anisotropic network that shows clear interference colors under the polarizing microscope when the system is heated above the clearing point of the LC. Supported by NSF ALCOM DMR89-20147, NSF DMR90-440635 and the German Institution DAAD.

**4:15 INDUSTRIAL RESEARCH IN AN ACADEMIC LABORATORY.** Paul E. Beck, Dept. of Chemistry, 325 Peirce, Clarion University of Pennsylvania, Clarion, PA 16214.

This paper will describe a very productive on-going research program at the academic-industrial interface between Clarion University and Kalama Chemical, Inc., Kalama, Washington, over the last three years. Their support has included summer salaries for student researchers; compensation for faculty and support personnel; and purchases of supplies and chemicals. Kalama Chemical, Inc., the largest domestic supplier of benzoic acid, sodium benzoate, and salicylic acid, has developed a corporate objective of entering the flavors and fragrance market. In this presentation, I will discuss the product line of Kalama Chemical, Inc. and the contributions of Clarion University undergraduate students to Kalama's corporate objective. Specifically, I will discuss the research on coumarin, our contributions to the commercial success of benzyl acetate, and our current efforts to develop new synthetic methods of salicylaldehyde. Our successes and failures and our communication with management will be addressed. The advantages of this arrangement to the student researchers will be emphasized.

## ELECTRICAL ENGINEERING

### 9:00 A.M., Saturday, May 1, 1993

### Cushwa Hall 1067

### Theo Keith, Presiding

**9:00 A FUZZY-LOGIC POWER SYSTEM STABILIZER.** Peter B. Idowu, Grove City College, 100 Campus Dr., Grove City, PA 16127.

Power system stabilizers (PSS) are commonly applied for reducing low-frequency oscillations in interconnected power systems, the conventional PSS schemes widely used are tuned for optimal performance at a prespecified point of operation. Since by its nature power systems continuously experience changes in configuration and operating levels, stabilizer design techniques that are self-adjusting and independent of fixed operating points are considered most suitable. In the design scheme proposed, samples of generator speed is converted into a set of "fuzzy" numbers through predefined linguistic membership distribution functions, human expertise in controlling the generating unit is represented as fuzzy rules of relations in a knowledge base which is used by an inference mechanism in determining an appropriate control action in the form of a geometric output function. The "non-fuzzy" PSS signal is obtained through the centroid defuzzifier method. The effectiveness of the scheme is demonstrated through simulation.

**9:15 APPLICATION OF NEURAL NETWORKS FOR FAULT IDENTIFICATION IN POWER SYSTEMS.** Sri R. Kolla, Dept. of Engineering, The Pennsylvania State University, Shenango Campus, Sharon, PA 16146.

Power systems occasionally experience faults. These faults must be identified and faulted elements must be disconnected for secure operation. For this purpose, protective relays are used. These relays were initially designed using electro-mechanical elements. Recently, microprocessors that perform signal processing tasks are used for protective relays. The use of artificial neural networks (ANN) for different power system applications is currently being investigated by several researchers. These networks are highly suitable for complex signal processing applications. In particular, an optimization technique allows a network to "learn" rules for solving a problem by processing a set of examples. This paper presents an application of ANN

for identifying different shunt faults on a three-phase power transmission line. A feed forward layered network structure is used. It contains three layers, input, hidden, and output. It is trained using the back-propagation algorithm with fault condition data. The performance is tested using the simulated fault signals on a transmission line.

9:30 A NEURAL NETWORK BASED CONTROLLER FOR UNCERTAIN DISCRETE SYSTEMS. Sri R. Kolla, Dept. of Engineering, The Pennsylvania State University Shenango Campus, Sharon, PA 16146.

The mathematical models used to design controllers for physical systems are often inaccurate due to the inevitable uncertainties. Controller designs based on these models may not perform adequately when applied to the actual physical systems. Recently, robust control design methods based on linear regulator approach are developed to stabilize linear uncertain discrete systems. These controllers are effective for certain parameter variation ranges. However, they cannot stabilize the systems for arbitrary perturbation types and ranges. This paper presents a neural network (NN) based controller that works in parallel with the existing robust controller to improve the overall performance. NN based controllers are very effective because they can "learn" system characteristics through back propagation. The proposed controller uses a layered NN. It contains three layers, input, hidden, and output. The back-propagation is used to train the NN. The controller design is illustrated with a simple example.

9:45 GENERATION SCHEDULING WITH SECURITY. Monir Ahmad, Pennsylvania State University at Erie, The Behrend College, School of Engineering and Engineering Technology, Station Road, Erie, PA 16563-1200.

Load flow problem for a big power system is a large problem that involves many variables and constraints. The solution of this problem requires a lot of computer memory and computational time. For on-line computations it is imperative to obtain a fast solution. The approach presented here cuts down both the computer memory requirement and the computational time. Solution of a load flow problem includes the real as well as the reactive power flows. Since the power flows are more sensitive to bus voltage angles and reactive power flows are more sensitive to the bus voltage magnitudes, the problem has been decomposed into two subproblems—one dealing with real powers and bus voltage angles and the other with reactive power and bus voltage magnitudes. The load flow constraints are integrated into the objective function. This cuts down computer memory requirement. Different objective functions are discussed to optimize computational time. The difficulty in obtaining the solution of the overall problem is that the separate solution of the two problems may not converge to a feasible solution. This difficulty was overcome by introducing a power balance constraint. Some other techniques were also used to obtain fast solutions. The method was tested on the IEEE 30-bus system. The results were very encouraging.

10:00 BREAK

10:15 SPECTRAL METHODS—IMPLEMENTATION OF COLLOCATION METHODS TO HEAT TRANSFER PROBLEMS. Mansour Zenouzi, Dept. of Engineering Technology, Youngstown State University, Youngstown, OH 44555.

Spectral methods belong to general class of weighted residual techniques which approximate continuous functions globally in terms of a truncated Fourier or polynomials series expansion. For problems with sufficiently smooth solutions, spectral methods provide exponential convergence. The most commonly used series expansions are the Fourier series for periodic problems and the Chebyshev and Legendre polynomial series for non-periodic problems. The choice of the basis functions and the manner of computing the expansion coefficients, or more precisely, the projection operator, which projects the continuous equation onto a finite real dimensional subspace, characterizes the method (e.g., Galerkin, tau, collocations, or Rayleigh-Ritz). The main purpose of this paper, however, is to demonstrate implementation of spectral collocation methods to the solutions of differential equations. The use of collocation methods simplifies the treatment of various boundary conditions and coordinates transformations considerably. It is especially convenient for differential equations with non-constant coefficient or for nonlinear differential equations. In the spectral collocation method, the basis functions are chosen as Lagrangian interpolants through the specified set of collocation points. In this method, the expansion coefficients are the values of functions at the collocation points. The most commonly used points are the Gauss-Lobatto Legendre (or Chebyshev) collocation points. The collocation method requires the differential equation to be satisfied exactly at the collocation points. Practical aspects of implementation of the Legendre spectral collocation method to solution of the stability of a radiating fluid in vertical enclosures are presented.

10:30 REMOTE DATA ACQUISITION SYSTEM. David R. Loker, The Pennsylvania State University at Erie, The Behrend College, School of Engineering and Engineering Technology, Station Road, Erie, PA 16563-0203.

This paper discusses the development of a remote data acquisition system which is used to communicate with the RS232 serial port on a personal computer. The complete remote data

acquisition system consists of the development of three stages: The data acquisition electronics, the data communication electronics, the software for the microcontroller, and the personal computer. First, the data acquisition electronics consist of a sample-and-hold circuit and an analog-to-digital converter interfaced to a microcontroller. The microcontroller converts the digital data to a serial format and transmits the data at an appropriate bit rate. Next, electronics are developed for infrared data communications. Infrared frequencies are used to avoid cabling between the data acquisition system and the PC by transmitting through the air. The data communication system consists of an infrared LED and a photodetector. To avoid noise caused by the reception of visible light, the infrared LED is modulated in the transmitter at a carrier frequency. The last stage of the system consists of the software development. First, software is written for the microcontroller to transform the data to an ASCII format. Next, software is written for the PC to communicate with the serial port. With the use of infrared data communication techniques, a remote data acquisition system is designed which communicates with the RS-232 serial port on a PC.

10:45 A DSP BASED UNIVERSAL INDUSTRIAL METER AND CONTROL SYSTEM. Faisal K. Fadul, The Pennsylvania State University in Erie, The Behrend College, School of Engineering & Engineering Technology, Station Rd., Erie, PA 16563.

Although several meter/controllers are available to monitor and control single functions such as current flow, voltage, power, and temperature, there are none which effectively implement these functions in a single unit with a single microcontroller or microprocessor. In this presentation, a Digital Signal Processor based universal instrument meter and control system capable of performing multifunction will be discussed. This project implements these functions in a single unit, with special consideration given to cost, size, and reliability. Although adaptability is also important, the specific use of this unit will be for control of an industrial oven. The instrument system is designed to provide high performance and high precision measuring capability to the bench and system user. The system operates with a digital output and will provide simple and understandable controls.

## ENGINEERING, GENERAL, CIVIL, & EDUCATION

1:30 P.M., Saturday, May 1, 1993

Cushwa Hall 1062

J. Alex de Abreu-Garcia, Presiding

1:30 POSITION CONTROL OF INDUSTRIAL ROBOTS. Anthony P. Messuri, 1786 Basil Ave., Youngstown, OH 44514.

Robotic residual vibration refers to the structural vibrations which continue after the completion of a movement by a robotic manipulator from one position to another. These low-frequency vibrations occur at the damped natural frequencies of the system and require a fixed amount of time at the end of the movement to allow the unwanted vibrations to settle. This paper develops a control method which will minimize the residual vibration in a robotic manipulator while reducing the time required to arrive at the desired final position. The application of this control method involves the design of an intelligent controller to test the structural dynamic characteristics of the robotic structure and analyze these characteristics in order to calculate the appropriate drive signal to control the residual vibration. The concept is based on reducing the input energy occurring at the system's resonant frequencies. The intelligent controller is also capable of evaluating the effectiveness of this calculated drive signal in reducing the residual vibration in the system. The intelligent controller was implemented for laboratory evaluation. The results of testing performed on various laboratory structures is presented and demonstrate the effectiveness of this technique for reducing residual vibration.

1:45 SIMULATION AND CONTROL OF A DOUBLE CONVEYOR SYSTEM WITH TAKE-UP LOOP. Michael E. Wroe, Dept. of Electrical Engineering, The University of Akron, Akron, OH 44325-3904.

In many industrial extruding processes, there is a double conveyor network consisting of a discontinuous process coupled to a continuous process through a take-up loop. The take-up loop is used to match the velocities of the discontinuous and continuous processes. Normally, the extruding process creates a disturbance on the continuous system. When the extruded material is elastic, this disturbance may propagate through the take-up loop and affect the discontinuous system. An analysis is performed to determine whether the disturbance will propagate through or be damped out by the take-up loop. If the disturbance propagates through the take-up loop, a control strategy, which alleviates the disturbance propagation problem, is developed and analyzed. This strategy consists of a constant tension controller and a stabilizing feedback controller. The constant tension controller eliminates the disturbance, while the feedback controller ensures stability of the closed-loop system.

**2:00 FEASIBILITY STUDY OF CO AND N<sub>2</sub> SEPARATION BY CONTINUOUS ADSORPTION TECHNOLOGY.** Leslie V. Szirmay and Raymond D. Limbacher, Dept. of Chemical Engineering, Youngstown State University, Youngstown, OH 44555-3020.

There is a renewed interest in the preparation of synthesis gases from coal for fuel production. In that, separation of CO from N<sub>2</sub> from air blown processes would be of great economical importance. As an extension of a DOE project, adsorptive separation of N<sub>2</sub> from CO was investigated. Measurements done using the exchange adsorption technique indicated that, overall, the CO is more adsorptive, providing that the binary mixture of CO and N<sub>2</sub> display ideal behavior. In this case, separation by moving adsorbent bed technology would be feasible. Ideality, however, could not be confirmed and further study is needed to determine aberration from ideality, if any.

**2:15 METHOD FOR DETECTION AND MEASUREMENT OF HYDROGEN PEROXIDE GAS CONCENTRATION IN FLOWING AIR.** Ronald P. Krahe and Roy E. Voshall, Penn State Erie, Behrend College, 8765 State Rd., Girard, PA 16417.

The purpose of this research was to investigate the use of the heat released in controlled hydrogen peroxide gas decomposition as a means of measuring its concentration in flowing air. A device was developed, comprised of an outer surface partially catalytic and partially inert, and an inner pair of thermistors held in close proximity. In addition, an electronic circuit for biasing the thermistors and measuring their response was developed. A microcontrolled environmental test chamber was built to expose the sensor devices. The sensor output voltage was monitored and recorded. Several sensors were built and tested under conditions of airflow from 0.28 to 0.61 l/s, air speeds of .25 to 1.5 m/s, air temperatures from 21 to 43°C, and hydrogen peroxide gas concentrations from 0 to 5.0 mg/l. Experiments were run to determine the temperature rise due to hydrogen peroxide gas decomposition, and the resultant electrical response of the sensors to varying concentrations of hydrogen peroxide gas, and also varying ambient temperatures and flow rates. Maximum differential temperature measured was 1.3°C, and amplified output voltage signals were 2.0 to 3.0 volts. Correlation coefficients between hydrogen gas concentrations and the electrical output signals were computed. The magnitude of the correlation coefficient was 0.998. The strong correlation is encouraging development of a commercial sensor.

## 2:30 BREAK

**2:45 CHEMICAL FIXATION OF STEEL SLAGS AND RPCC FOR CONTINUED USE AS SUBBASE MATERIAL.** Jwan D. Gupta, William A. Kneller, and Parkaj K. Mahajan, The University of Toledo, Toledo, OH 43606.

Open Hearth (OH), Basic Oxygen (BOF), and Electric Arc Furnace Slags and Recycled Portland Cement Concrete (RPCC) are used as subbase aggregates in many highway projects throughout north-eastern Ohio. A calcareous material "TUFA" has been observed occluding highway drains, catch basins, and geotextiles. Previous studies indicate the free lime (CaO) in the steel slags is the primary source of the precipitates under high pH conditions and where evaporation occurs. If these slags and RPCC's are to be used as subbase aggregates, they will require the chemical fixation of the CaO. Nine slags and two RPCC samples were studied to determine their leachate characteristics in CO<sub>2</sub> charged deionized water. The Ethylene glycol (sugar) tests were performed to determine CaO content of these samples and was found to provide a good indicator as to the tufa producing potential of these slags. Acidic, Class F fly ash was mixed at concentrations of 1, 3, and 5 weight percent with the slag samples. The 'sugar' tests show a 44% reduction in CaO from the unweathered BOF slag when 5% fly ash was used. The aged OH slags show a reduction of 41% and the EAF slag show the minimum reduction of 30%. The CaO content in RPCC samples, however, increased by as much as 16.67%. This fixation reduces the potential of steel slags to precipitate tufa and may lead to the continued use of these slags as subbase aggregates. However, further research is needed to explain the anomalous results in the RPCC samples.

**3:00 NONDESTRUCTIVE EVALUATION AND TESTING OF WELDMENTS.** Todd S. Fleckenstein, 4220 Burkey Road, Austintown, OH 44515.

Nondestructive Evaluation and Testing (NDT) is a very fundamental tool of Engineering Science. Knowing the ability of materials joining processes to withstand the expectations of users for safety, function, reliability, and efficiency while remaining economically priced are the challenges of today's engineers and scientists. Destructive testing of product samples is no longer considered adequate as a single testing criteria in determining the welding parameters to be utilized. With the advent of today's hi-tech, hi-strength, lightweight materials, and the pressure for efficient materials and processing methods, emphasis must be placed upon the use of NDT. Using NDT data generated during the manufacturing process and in-service use, the results of inspections (or evaluations), can be used as feedback to engineers to assist in selecting the best materials, designs, and joining processes necessary for the desired quality level. Understanding the relationship of inherent (and processed) defects and discontinuities during the service-life is as important to the engineer or scientist as process feedback. The science of NDT includes

those methods and techniques of inspection or detection of any parameter, property or performance capability, without altering, destroying, or affecting a product's features, functions, or use. The five most readily recognized and used methods of NDT include: Liquid Penetrant Testing (LPT), Magnetic Particle Testing (MT), Ultrasonic Testing (UT), Radiographic Testing (RT), and Electromagnetic Testing (ET). In order to guarantee accurate data, unique qualifications are required of personnel who perform the testing, while calibration of the test equipment to known standards is required to assure accuracy.

**3:15 STONE MATRIX ASPHALT TECHNOLOGY.** Shakir Husain, Assistant Professor, Dept. of Civil Engineering, Youngstown State University, Youngstown, OH 44555.

Stone Matrix Asphalt (SMA), a relatively new highway construction technology, is slowly gaining momentum in the United States of America. It is a gap graded aggregate asphalt hot mixture that provides a stable-on-stone skeleton which is held together by a rich mixture of asphalt cement, filler, and stabilizing additives. Recently, several states have either constructed or planned for construction a test section using SMA technology. This paper discusses the current experience in these states under actual traffic conditions.

**3:30 NORMALIZATION OF SKID NUMBER OBSERVATION FOR IMPROVED PAVEMENT-MANAGEMENT DECISIONS.** Subhi M. Bazlamit and David C. Colony, Civil Engineering Dept., The University of Toledo, Toledo, OH 43606.

Skid resistance of pavement surfaces is the friction force in the tire-pavement interface. The objective of this research is to establish a normalization procedure that will enable measurements of tire-pavement friction at different temperatures to be normalized to a tire-pavement friction level at a specific standard temperature such as 68°F. The friction force in the tire-pavement interface is made of two components: adhesion and hysteresis. The adhesion component is the result of the interface shear strength, and the hysteresis component is the result of damping losses within the rubber of the tire. Both components of tire-pavement friction are dependent on the actual contact area available in the interface. Laboratory briquettes from different roads in Ohio were prepared. Pavement friction measurements on the briquettes were conducted using the British Pendulum Tester. These measurements were taken at different levels of temperature in a laboratory-controlled environment. The components of rubber-pavement friction were measured separately in the laboratory using water and hand soap as lubricants. A laboratory procedure was developed to produce images of the actual contact area available in the tire-pavement interface. An image processing computer was used to estimate the area of contact in those images.

**3:45 FACULTY-STUDENT LEARNING TEAMS: BRINGING INDUSTRY INTO THE CLASSROOM.** S.R. Pansino, Dept. of Electrical Engineering and Lester W. Smith, Professor of Mechanical Engineering, Youngstown State University, Youngstown, OH 44555.

ABET is placing greater emphasis on the use of the capstone design experience in the engineering curriculum in response to increasing dissatisfaction expressed by industry with the performance of new engineering graduates. The causes of this concern are many; however, two issues seem to be the crux of the matter: The changing nature and needs of engineering students, and the lack of understanding of what is required to be successful in industry. Both of these need to be addressed before a quality capstone experience can be provided. To accomplish the educational objectives, faculty members with industrial experience can bring to the classroom the team building skills and experiences which are a natural occurrence in the solution of industrial problems. Electrical engineers and mechanical engineers are frequently involved in these kinds of efforts. The authors, both with extensive industrial experience, present a program that emphasizes team building and inter-disciplinary projects to give the students "real world" educational experience.

**4:00 THE MINI-BAJA COMPETITION AS A CAPSTONE DESIGN EXPERIENCE.** Lester W. Smith, Professor of Mechanical Engineering, Youngstown State University, Youngstown, OH 44555.

Engineering educators are being urged to include meaningful, open-ended design projects in their capstone design courses. Many faculty members can draw upon consulting experience to provide real-world problems for their students. However, the SAE-sponsored Mini-Baja Competition which is held at several regions across the country provides a total design experience for senior students. Design of component parts in the course setting, followed by construction of the buggy, field testing of the buggy, modifying the design as necessary, and then capping the program in a real-world competition with other schools and universities gives the students a realistic picture of how the business world operates. It is an experience that they can cherish long after graduation. This paper discusses the Mini-Baja program in an actual course.

**4:15 WIND TUNNEL TESTS ON BLUFF BODIES USING A COMPUTERAIDED SENSOR SYSTEM.** Ganesh V. Kudav, Mechanical Engineering, Youngstown State University, Youngstown, OH 44555.

Fluid flow around bluff bodies is characterized by boundary layer separation and consequent formation of turbulent wake regions behind them. The bluff body, therefore, experiences significant pressure drag in the direction parallel to the flow. Automakers conduct wind tunnel tests of full-scale vehicle models to measure aerodynamic forces using sophisticated sensor systems. Such forces are reduced by streamlining the exterior vehicle-body. The objective of this work is to provide engineering students with hands-on experience in wind-tunnel testing. A 6-component sensor and associated hardware are used in a low-turbulence wind tunnel having a test cross-sectional area of 14" by 14". The test model is mounted on the sensor. The sensor carries extremely sensitive strain gages on bridges and is interfaced with Hewlett-Packard System 10+ Data Acquisition System. A driver program on a PC converts the bridge voltages into forces and moments, controls the data acquisition system, and displays results in graphical mode and in numeric values. Through wind tunnel tests on a sphere and flat plate (perpendicular to flow), students validate published results that drag coefficient is independent of Reynolds number for a wide range of flow speeds. Tests on car and truck models show that proper streamlining and use of add-on devices such as fairings, air deflectors, and spoilers can reduce drag and lift forces.

**4:30 ANALYTICAL MODELING OF ALUMINUM EXTRUSION PROCESS AND DIES.** Yean-Janq Huang, Richard W. Jones, Jay S. Gunasekera and \*Jakanth Rumblekere, Materials Engineering Dept., Youngstown State University, OH 44555. \*Dept. of Mechanical Engineering, Ohio University.

The most common problems in the aluminum extrusion process are: 1.) inconsistent material flow of extrudate; 2.) surface defects like hot-shortness and incipient melting; and 3.) difficulty in maintaining dimensional tolerances. These problems are caused by several factors such as improper material velocity flow across the die land, high strain rates, incipient melting of second phase particles due to localized adiabatic heating, and variational die deflection during the extrusion process. These critical parameters are impossible to measure experimentally due to the complexity of the actual process. A close to realistic 3-D FEM of the extrusion process using PATRAN and ABAQUS (run at the Ohio Supercomputer Center) has been established to model and investigate the extrusion process in order to obtain close dimensional tolerances and the desired microstructure of the extrusion without any surface defects. The results of this research include: 1.) the velocity field of material flow through the die; 2.) strain rate and temperature distribution across the billet; and 3.) die/tooling deflection during the extrusion process. The analysis result will help designers control the extrusion process and design effective die tooling.

**4:45 MATERIAL CHARACTERIZATION AND PROCESS MAP OF ALUMINUM ALLOY 6063.** Yean-Janq Huang, Richard W. Jones, Tao Kuan and Theodore F. Yurek, Materials Engineering Dept., Youngstown State University, OH 44555.

The isothermal flow curves of material AL6063 have been determined at temperatures of 360° C to 590° C and constant true-strain rates of 1 S<sup>-1</sup> to 15 S<sup>-1</sup> using compression tests of cylindrical specimens. Using Dynamic Material Modeling, the Material Stability Map, Efficiency of Power Dissipation Map, and Activation Energy as a function of temperature and strain rate have been established and an optimal process range for the alloy was determined. The optimal process range for A16063 below a strain rate of 15 S<sup>-1</sup> was confined within 460° C and 560° C. The microstructure evolution of AL6063 during the hot compression tests was investigated. The result indicated the material process map correlates well with the microstructure and corresponding mechanical properties. A microstructure contour was superimposed on the material process map to define the boundary of the process window. Material instability such as micro void formation and incipient melting found in microstructure analysis can be readily predicted by Dynamic Material Modeling.

## ELECTRICAL ENGINEERING & MACHINE VISION

### 1:30 P.M., Saturday, May 1, 1993

### Cushwa Hall 1067

### Theo Keith, Presiding

**1:30 COMPRESSION AND RECONSTRUCTION OF MEDICAL IMAGES SEQUENCES.** Mark E. Shields & James B. Farison, Dept. of Electrical Engineering, The University of Toledo, Toledo, OH 43606.

This paper reports results of digital image processing of a spatially invariant temporal image sequence. A spatially-invariant image sequence is a sequence of images taken with no relative object-sensor motion, so that all of the features in the image sequence are in the same spatial position in each image of the sequence. The sequence of nonidentical images is obtained by the variation of some imaging system parameter or temporal property of the object(s). Recent results in the modeling and analysis of linearly additive spatially-invariant image sequences are based on the inherent structure of such images. A technique called "simultaneous diagonalization (SD) filtering" can be used to achieve significant data compression for image storage and

still provide good reconstruction. The technique is applied here to a human renogram with compression of a very noisy 180-image sequence to a much smaller image set. Due to the extremely noisy nature of this nuclear medicine image sequence, SD image sequence filtering is combined with standard image processing techniques to enhance the reconstruction. Traditional methods such as median filtering and spatial average filtering and/or temporal methods such as unweighted and weighted temporal averaging are applied to the image sequence prior to application of SD. The resulting image reconstructions illustrate the potential of the combination of SD and traditional methods.

**1:45 APPLICATION OF FILTERING TECHNIQUES TO A MULTISPECTRAL IMAGE SEQUENCE.** Janice L. Bergmooser & James B. Farison, Dept. of Electrical Engineering, The University of Toledo, Toledo, OH 43606.

This paper reports results of digital image processing of a spatially invariant multispectral image sequence. Digital image processing is one of the current techniques used in performing industrial, medical, satellite, or other studies, and is particularly well developed for grey-scale images. Spatially invariant image sequences are formed by holding the relative object-image sensor position constant while varying some aspect of the image formation process. A multispectral image sequence is one such sequence in which a series of grey-scale images are formed in different spectral ranges by varying the wavelength of the light at which each image is taken. This is done optically by using colored filters which allow only specified wavelengths to pass from the light source to the recording equipment, or by digital filtering of the spectrum of the colored image data. Multispectral image sequences are particularly useful in imaging applications involving a colored object or scene of interest. Special filtering techniques appropriate for spatially invariant image sequences are applied to a multispectral grey-scale sequence to enhance desired or suppress interfering features of the image, and demonstrate the usefulness of such filtering on a multispectral grey-scale image sequence of a colored object.

**2:00 MULTISPECTRAL IMAGE FILTERING FOR FEATURE SEPARATION AND SUPPRESSION, DATA COMPRESSION, AND RECONSTRUCTION.** Ghassan E. Sharara & James B. Farison, Dept. of Electrical Engineering, The University of Toledo, Toledo, OH 43606.

This project investigates the application of a novel image processing technique in machine vision involving colored objects. Machine vision has become a leading industrial technology for non-contact inspection and sorting of objects. Typically, this involves image processing and analysis of a single grey-scale image of each object. However, with colored objects, there is much more information available than can be captured with a single grey-scale image. One can form a sequence of grey-scale images, each one representing a different spectral range (color component). This image sequence is spatially invariant and can be made linearly additive, which allows the use of a new technique called "simultaneous-digitalization (SD) filtering". The method is applied here to multispectral image sequence, obtained from an object consisting of partially-overlapping colored plastic strips. Results illustrate the success of SD filtering in separating features with different spectral characteristics (different color), in removing an undesired overlapping feature, in compressing an image sequence into a smaller sequence (data compression), and in reconstructing the original sequence from the compressed set. A second application involves sorting of a variety of manufactured colored ceramic tiles; some of which are almost indistinguishable to the eye or to a single grey-scale image.

**2:15 EXPERIMENTAL MEASUREMENT OF CONTACT AREA BETWEEN PAVEMENT AND TIRE SAMPLES USING MACHINE VISION AND IMAGE PROCESSING.** Michael S. McKinley and James B. Farison, Dept. of Electrical Engineering, The University of Toledo, Toledo, OH 43606.

Skid resistance of pavement surfaces is the friction force in the tire/pavement interface. The friction force, in turn, is dependent on the actual contact area between the tire and the pavement. Thus, one of the variables to be determined in skid resistance research is the actual contact area (which is less than the total area, due to the unevenness of the two surfaces). Measurement of the contact area is complicated by the inaccessibility to the area during contact. An alternative method of estimating the contact area using machine vision is described in this paper. The tests involve laboratory briquettes representing different roads in Ohio and tire rubber samples. Before performing the contact experiment, the briquette is coated with white latex paint. During the experiment, pavement and tire contact is made under various sample and compression (load) conditions. This contact transfers paint to the rubber sample over the area of contact. After separating the pavement and rubber samples, an image of the rubber sample is recorded with a CCD camera. The image is transferred to a PC through an image capture board, and the contact area is estimated from the white surface with image processing software.

**2:30 ON THE PERFORMANCE OF PHASE SHIFT KEYING USING MULTIDIMENSIONALITY.** Junghwan Kim, The University of Toledo, Dept. of Electrical Engineering, 2801 W. Bancroft St., Toledo, OH 43606.

With the increasing demand for communication service, the research for bandwidth and power efficient modulation systems has become a very active area. Usual approach to expand signal

constellation of PSK utilizes different channels in time of frequency domain. Hence, they could not achieve extra efficiencies without using other techniques; such as TCM. Conventional orthogonal modulation was proposed to increase power efficiency with a trade-off in bandwidth efficiency. On the other hand, Multiple PSK is used to increase the bandwidth efficiency by trading off power efficiency. To avoid trade-off while maintaining the better performance may be the answer in our study. By using a hybrid of the M-ary FSK and M-ary PSK, this goal can be achieved. A set of mutually orthogonal carrier frequencies with minimum spacing can be used. Each carrier is then MPSK modulated. Expressions for the bandwidth efficiency show that it is possible to achieve twice the conventional bandwidth efficiency of MPSK while its power efficiency is maintained as of MPSK.

## 2:45 BREAK

**3:00 VHDL SIMULATION OF A SYSTOLIC ARRAY ARCHITECTURE FOR THE SLINK CLUSTERING ALGORITHM.** P.C. Mohanty, Dept. of Electrical Engineering, M.Y. Niamat, Dept. of Engineering Technology, M.M. Jamali, Dept. of Electrical Engineering, University of Toledo, Toledo, OH 43606.

VHDL is an acronym for VHSIC (Very High Speed Integrated Circuit) Hardware Description Language. VHDL modeling is most useful in the design stage before internal implementation is finalized. In VHDL, behavioral models specify a component's function in the form of sequential statements, and it is not essential that the internal structure of components be known. Furthermore, a system's organization and structure are expressed as a hierarchical arrangement of interconnected components. In this paper, the VHDL simulation of a systolic array architecture for computing the similarity matrix in the SLINK (single linkage) clustering algorithm is presented. The architecture utilizes the processors for computing addition, subtraction, multiplication, and for finding the square-root. All the processors are clocked by a universal clock. 'PROCESS' statements define the values of their output signals as a function of their input signals, over time. These statements are used to create the behavioral model of each processor using sequential statements. Each model is simulated for correct operation. The symbols for the processors are developed and they are used to create the block level schematic of the architecture for a  $(4 \times 4)$  input data matrix. The architecture is simulated at the logic level and verified to be functionally correct.

**3:15 DESIGN OF SYSTOLIC ARRAY ARCHITECTURE FOR A HIERARCHICAL CLUSTERING ALGORITHM.** P.C. Mohanty, Dept. of Electrical Engineering, M.Y. Niamat, Dept. of Engineering Technology, M.M. Jamali, Dept. of Electrical Engineering, University of Toledo, OH 43606.

Systolic arrays are networks of processors that rhythmically compute and pass data through systems. These arrays feature the important properties of modularity, regularity, local interconnections, and a high degree of pipe lining and multiprocessing. As a result of these characteristics, systolic arrays are computationally efficient. In this paper, the design and analysis of a systolic array architecture for use in the SLINK (single linkage) clustering algorithm is presented. The SLINK algorithm is widely used in cluster analysis, and has tremendous potential for real-time applications including image-processing and pattern recognition. However, this algorithm requires considerable computational time for its execution, which limits its applications. The systolic array architecture designed in this research alleviates this problem by reducing the computational time. The architecture requires separate processors for computing subtraction, addition, multiplication, and for finding the square root. The operation of the systolic array is verified by means of time snapshots and time space diagrams. The performance parameters of the systolic array are derived, and it is found that for an  $(m \times n)$  input data matrix, the total computational time is of the order of  $\{(3 + m + n) + \{(n-2)(n-1)/2\}\}$ .

**3:30 CMM PROBE COMPENSATION IN CONTOUR DIGITIZING.** Mohammad M. Haq and Robert J. Abella, The University of Toledo, Industrial Engineering, 2801 W. Bancroft, Toledo, OH 43606.

Probe compensation in contour digitizing is extremely important in Reverse Engineering. The curve fitted through the data points obtained by digitizing is, in fact, the locus of the center of the digitizing probe, not the surface of the work. Normal procedure is to move the probe normal to the work. Making the probe approach normal to the surface is extremely difficult and time consuming. A parametric spline through the locus of the probe centers described by the point and tangent vectors is a contour that must be formed by digitizing. The tangent vector components at any point along the curve and the direction cosine of the normal have been calculated. The curve consisting of points is then offset along the normal direction a distance equal to the radius of the probe. The proposed method will eliminate the need for a normal approach of the probe and result in significantly faster digitizing, and minimum error in programmed digitizing.

**3:45 PLASMA DISPLAY CONTROL WITH MC68HC11E9 MICROCONTROLLER.** Devincler Kaur and B.K. Velayudhan, Dept. of Electrical Engineering, University of Toledo, Toledo, OH 43606.

Plasma display panels are widely used in industry. To control the different parameters of a picture on a plasma display panel, like color contrast A/D rail and dot clock, special purpose switches are used which generate two different pulse patterns. If any of the control parameters needs to be increased or decreased, the corresponding switch is rotated in a clockwise or anticlockwise direction, resulting in the generation of two different kinds of patterns of pulses on the two channels. The width of pulses is typically 8 ms and the time difference between the two pulses is 3 ms. In this paper, a cost-effective technique to replace these switches using MC68HC11E9 microcontroller is presented. The MC68HC11E9 is an advanced 8-bit microcontroller (MCU) with highly sophisticated on-chip peripheral capabilities. The Input Capture (IC) and Output Compare (OC) features of the MCU are used for the control logic. The control circuitry consists of an Input Block, MCU, and an Output Selection Block. The Input Block has debounced switches for each of the control parameters. A logic 'high' is detected on one of the Input Capture lines whenever the related switch is pressed, which results in the generation of unique pulse patterns on the output compare lines. The paper presents the hardware interface and the control software developed for MC68HC11E9 to implement the Plasma Display Control.

**4:00 MICRO CONTROLLER AND DIGITAL SIGNAL PROCESSING.** Seyed Akhavi, College of Engineering, Youngstown State University, Youngstown, OH 44555.

New advances in digital electronics have made it possible to manufacture microcontrollers which are capable of analyzing and processing signals. Now applications that require bulky components and complex hardware can be implemented by using microcontrollers. The auto industry is using these single chips to monitor and control the speed of the engine, fuel injection rate, and spark timing. Precision electronic instruments, peripheral devices, communication devices such as pagers, laser printers, color copiers, are all equipped with one or more microcontroller chips. A modern approach which takes full advantage of the microcontroller's programmability, has made it feasible to simulate such tasks as filtering in the digital domain. This thesis investigates the design and implementation of a 5-band audio signal analyzer by using the latest 16-bit microcontroller manufactured by Motorola. Methods and techniques involved in the areas of analog-to-digital conversion, digital signal processing, serial interfacing, and related programming routines are discussed and developed. Hardware as well as software design goals, with the emphasis on programmability of microcontrollers, are presented.

**4:15 TRANSPUTER BASED REAL-TIME PRESS CONTROL.** Sasidhar V. Challa, College of Engineering, Youngstown State University, Youngstown, OH 44555.

A transputer based real-time process control system is designed and its performance is studied. The emphasis is placed on the hardware and software aspects of the transputer, i.e., installation, networking, and interfacing to the test control system. The process control system consists of a stirred tank heater containing water. The temperature of the water is measured using a thermocouple and controlled using proportional control algorithm. The control algorithm is implemented on a transputer network using OCCAM, which is the parallel processing language for the transputer. Software development, implementation, and user interface are achieved through an IBM Personal Computer (PC/AT clone). Data acquisition and control are achieved through a Data Acquisition Control Unit that is interfaced to the transputer network and, hence, to the user via the IBM PC.

## MOLECULAR GENETICS

### 9:00 A.M., Saturday, May 1, 1993

### Cushwa Hall 1095

### Rod Anderson, Presiding

**9:00 MOLECULAR CHARACTERIZATION OF A NEUROFIBROMATOSIS TUMOR CELL LINE.** Sondra J. Livingston-Carr, College Of Wooster, Box C-2127, Wooster, OH 44691 and Gary R. Skuse, University of Rochester School Of Medicine, Rochester, NY 14618.

A molecular characterization of a Neurofibromatosis tumor cell line, NFRL91, was completed. The Neurofibromatosis gene, NF1, is thought to encode a tumor suppressor, since the putative gene product contains the GAP related domain (GRD). For this analysis, the cell line was cultured and the malignancy was determined due to the absence of contact inhibition. Several molecular techniques were used for the analysis including the polymerase chain reaction (PCR), single stranded conformational polymorphism (SSCP), and Southern blotting with probes from the entire cDNA. No mutations were found with the PCR or SSCP analyses; however, the results of Southern blotting detected specific alterations in NFRL91 with particular probes. Further analysis is being performed to more precisely localize the mutation.

**9:15 ANALYSIS OF THE FUNCTION OF THE PROTEIN TYROSINE KINASE PRODUCT OF THE KIN-16 GENE IN CAENORHABDITIS ELEGANS.** Marya L. Cross and William R. Morgan, The College of Wooster, Wooster, OH 44691.



Receptor-type protein tyrosine kinases are proteins that phosphorylate substrate proteins at specific tyrosine residues. This action is involved in cell-cell communication pathways of cell growth and organism development. Two genes in the nematode *C. elegans*; *kin-15* and *kin-16*, code for two uniquely structured RTKs. Their predicted products have truncated extracellular domains. The functions of these two proteins are unknown. However, these genes are similar to the *c-kit* gene in the mouse genome. Therefore, it is possible to study the *C. elegans* genes in comparison to the mouse gene. This study compares the mutations  $W^{42}$  and  $W^{55}$  in the *c-kit* gene with analogous mutations in the *C. elegans* genome. This study utilized "reverse genetics" and "dominant negative" mutations to study the function of the gene product of *kin-16*. DNA from *C. elegans* was mutated using the single-strand primer method and ligated into a vector with an inducible promoter. This vector will then be introduced into *C. elegans* and the phenotypes of the progeny will be analyzed at different stages of growth in order to understand the role of the gene product in development.

9:30 USE OF THE PARTICLE INFLOW GUN TO INTRODUCE DNA INTO *CAENORHABDITIS ELEGANS*. Kim R. Finer and William R. Morgan, Dept. of Biology, The College of Wooster, Wooster, OH 44691.

We have studied the feasibility of using the Particle Inflow Gun to introduce genetic material into the nematode, *Caenorhabditis elegans*. A synchronized population of worms was placed into a vacuum chamber and then bombarded with DNA-coated tungsten particles which were accelerated by helium burst. Both stable and transient expression patterns were evaluated using different transformation strategies. Transient expression of the introduced DNA was evaluated by bombarding wild type worms with a *lacZ* fusion plasmid. Expression of the *lacZ* gene was detected using histochemical staining. Stable transformation was evaluated by looking for rescue of the *unc-54* paralysis defect following bombardment with plasmid pUNC54. Progeny of bombarded worms were screened by looking for moving animals. Transient express of introduced DNA has been detected at frequencies of 1-2%, while no stable transformants have yet been detected. These preliminary results suggest that introduction of DNA into worms using particle bombardment is a viable, economical alternative to the currently employed technique of microinjection. However, bombardment parameters must first be optimized to increase transformation efficiency.

9:45 CLONING OF A SIGNAL-SEQUENCE-DEFICIENT  $\alpha$ -AMYLASE GENE INTO *ESCHERICHIA COLI*. Marie S. Dennis-Harrison, Rodney P. Anderson, Dept. of Biological Sciences, Ohio Northern University, Ada, OH 45810.

The purpose of the project was to clone a signal-sequence-deficient variant of the  $\alpha$ -amylase gene from *Bacillus subtilis* into *Escherichia coli*. The chromosomal DNA from *B. subtilis* was isolated by phenol extraction and the  $\alpha$ -amylase gene was amplified by the polymerase chain reaction (PCR). Primers were chosen to amplify only the portion of the gene downstream of the signal sequence. Consequently, the 5' start of the gene which codes for the first 32 amino acids that make up the signal sequence was not amplified. After purification, the PCR product was digested with appropriate restriction enzymes and ligated into the plasmid pBluescript. This recombinant plasmid was transformed into *E. coli* strain DH11S. Ampicillin-resistant transformants were screened on X-Gal plates to isolate colonies containing the PCR-amplified insert. Analysis of the insert and intracellular expression of the signal-sequence-deficient  $\alpha$ -amylase gene is in progress.

10:00  $\alpha$ -AMYLASE ENZYME ASSAY. Mauricha A. Frazee, Rodney P. Anderson, Meyer Hall, Ohio Northern University, Ada, OH 45810.

$\alpha$ -amylase (1,4- $\alpha$ -D-Glucan glucanohydrolase, E.C.3.2.1.1) catalyzes the hydrolysis of  $\alpha$ -1,4 glucan bonds in polysaccharides (e.g. starch), which results in the formation of dextrins and a number of reducing sugars. Several different assay methods for  $\alpha$ -amylase activity were conducted and compared. The purpose of the project was to find a method which could rapidly and accurately assay a large number of cell extracts to determine the level of enzyme activity. Soluble starch was used as the substrate in all tests. The  $\alpha$ -amylase used in the initial experiments was obtained commercially. Assay methods employed were based on an iodine reaction for colorimetric determination and determination of the reducing groups. On the basis of several tests, it was concluded that  $\alpha$ -amylase activity could be best measured by the dinitrosalicylic acid reducing test. The reducing hemiacetal groups of starch hydrolyzed by  $\alpha$ -amylase can be determined by 3,5-dinitrosalicylic acid. The concentration of the dinitrosalicylic acid formed is measured colorimetrically and corresponds to the newly formed terminal groups produced by the enzyme activity. This test was the most useful because the rate of reaction was determined to be proportional to the enzyme activity as well as the substrate concentration. The measurements of the activity of  $\alpha$ -amylase in cell extracts in *Escherichia coli* is continuing.

10:15 DETECTING THE PRESENCE OF THE AhcY GENE IN *ARABIDOPSIS COLOMBIA* AND *RHODOSPIRILLUM CENTENUM*. Leslie A. Bober and Monika Becker Rudzik, Box 1075, Westminster College, New Wilmington, PA 16172.

AhcY codes for the enzyme, S-adenosyl-L-homocysteine hydrolase, an enzyme of the activated

methyl cycle leading to the production of bacteriochlorophyll in *Rhodobacter capsulatus*. It has been shown by Dr. Carl Bauer that there is a 64% identity between the gene in humans and in *R. capsulatus*. Through the techniques of polymerase chain reaction, or PCR, and gel electrophoresis, we have shown the presence of AhcY in *A. columbia*. Using the techniques of complementation of *R. centenum* DNA and a *R. capsulatus* DNA library, and matings, we have also proven the presence of AhcY in *R. centenum*.

10:30 EXAMINATION OF ONE MITOCHONDRIAL AND THREE NUCLEAR GENES FOR POLYMORPHISMS IN THE FAMILY CANIDAE. Stacia L. McMahon and Bonnie L. Lamvermeyer, Dept. of Biology, Denison University, Granville, OH 43023.

The goal of the research is to discover genetic differences among domestic dogs, coyotes, wolves and their hybrids. DNA is extracted from blood, spleen, liver and muscle tissue by carcasses. The extraction is performed with varying amounts of phenol, chloroform, isoamyl alcohol and ethanol. The extracted DNA is amplified using the Polymerase Chain Reaction (PCR). Primers have been developed to target nuclear and mitochondrial genes of base pair sizes from 300bp to 1300bp. These include the region of the Y-chromosome, complement factor 3 and mitochondrial cytochrome oxidase III. PCR conditions for the above primers have been optimized at thirty-five cycles of 95°C (one minute), 57°C (two minutes) and 72°C (three minutes). The PCR products are analyzed by electrophoresis on agarose gels after digestion with restriction endonucleases. Included are the following enzymes with recognition sequences of 4-5 base pairs in length; Hae III (5'-GG/CC-3'), Hinf I (5'-G/ANTC-3'), Rsa I (5'-GT/AC-3') and Bst N I (5'-CC/(A,T)GG-3'). Results will be important for determining the identity of predators of livestock by evidence left at the kill site. The research may also prove to restructure existing evolutionary theories about the canine's origin and subsequent radiation to domestic dogs, coyotes and wolves.

10:45 DNA FINGERPRINT VARIATION IN ARABIAN AND STANDARD BRED HORSES. Meegan S. McCarthy, Monika Becker Rudzik, and Patrick McCarthy, Dept. of Biology, Westminster College, New Wilmington, PA 16172.

This project investigated DNA fingerprint variability in two horse breeds, Arabian and Standardbred, using the SNAP probe and the Southern Blot procedure. Statistical analysis using the similarity index of Jeffreys and Morton was used to estimate the probabilities that two unrelated horses of the same breed have the same DNA fingerprint. A similar study has also been performed by Byrnes and Bernoco with Andalusian, Morgan, Quarterhorse, and Thoroughbred breeds. This descriptive study attempted to expand on that study to document the level of genetic variation existing within Arabians and Standardbreds.

## CELL & MOLECULAR BIOLOGY

1:30 P.M., Saturday, May 1, 1993

Cushwa Hall 1095

Rod Anderson, Presiding

1:30 INDUCIBLE CELL FUSION RECEPTOR ANALYSIS OF ISOLATED PLASMA MEMBRANE FRACTIONS OF THE MYXOMYCETE *DIDYMIUM IRIDIS*. Joseph M. Restivo and John J. Yemma, Youngstown State University, Dept. of Biological Sciences, Youngstown, Ohio 44555.

Data are presented which focus on changes that occur in the cell surface glycoproteins of *Didymium iridis*, which permit cell fusion to occur in previously induced cells. It was therefore necessary to develop a reliable method for the isolation of pure plasma membrane fractions, prior to the characterization of mating and fusion factors. Chromatographic analysis of isolated plasma membrane fractions of pre-fusion (uninduced) versus fusion competent (induced) myxamoeba were carried out. Isolation of the plasma membrane of cells was carried out by a technique utilizing density gradient centrifugation in a linear sucrose gradient which produced a highly pure membrane fraction. Results demonstrate differences in the plasma membrane glycoprotein profiles of induced versus uninduced cells, indicating a fusion receptor. During the induction period prior to fusion, the plasma membrane undergoes dynamic changes in which fusion factors are made active through conformational changes of specific membrane proteins. These changes that occur would account for these differences of membrane glycoproteins in induced versus uninduced plasma membrane fractions.

1:45 GLYCOSYL-PHOSPHATIDYLINOSITOL-ANCHORED MEMBRANE PROTEINS: A NEUTROPHIL MODEL. Timothy J. Cain, Youjiang Liu and John M. Robinson, Dept. of Cell Biology, Neurobiology and Anatomy, The Ohio State University, 333 W. Tenth Ave., Columbus, OH 43210.

In human peripheral blood neutrophils alkaline phosphatase (AlkPase) and the immunoglobulin G receptor FcRIII (CD16) are membrane associated proteins tethered to the outer leaflet of the

lipid bilayer via a glycosyl-phosphatidylinositol (GPI) anchor. In unstimulated cells the bulk of AkPase and FcR1II is intracellular ( $\approx 20\%$ ) but can be up-regulated to the cell surface ( $> 85\%$ ) in a stimulus-dependent manner. These two GPI-anchored proteins and others are characterized by their susceptibility to release from the lipid bilayer by phosphatidylinositol-specific phospholipase C and their relative resistance to Triton X-100 detergent extraction. In the present study we show that detergent extraction of AkPase and FcR1II is relatively ineffective at  $4^\circ\text{C}$ , but can be effectively remedied if the lysis temperature is raised to  $37^\circ\text{C}$ . Disruption of cytoskeletal elements nor the degree to which AkPase is expressed on the cell surface had an effect on its differential extractability. In addition, AkPase and FcR1II can be colocalized on the surface of these stimulated non-polar cells complementing studies in which others have noted the preferential sorting of constitutively expressed GPI-anchored proteins in polarized epithelial cells [Simon & Fuller (1985) *Annu. Rev. Cell. Biol.* 1:243; Brown Rose, (1992) *Cell* 68:533].

**2:00 LOCALIZATION OF THE CYTOSKELETAL ELEMENTS, SPECTRIN AND ACTIN, IN *PHYCOMYCES*.** Caroline J. Leonard, PO Box 1405, Gambier, OH 43022.

Gravitropism is growth movement toward or away from the earth's gravitational force. The events leading to gravitropism are detection, transduction, and response; detection being the focus of this investigation. The terrestrial fungus, *Phycomyces blakesleeanus*, is my model system. The nature and location of the gravireceptor in *Phycomyces* is unknown; one hypothesis is that the cytoskeleton is part of the receptor system. This study attempts to elucidate this role. The *Phycomyces* sporangiotheca is a single cell, 95% vacuole. When a sporangiotheca is placed perpendicular to the gravitational field, the buoyant vacuole rises and may strain cytoskeletal elements connecting the tonoplast to the plasma membrane. This strain can be conferred to stretch activated ion channels in the plasma membrane or tonoplast, causing channel openings which lead to an alteration of ion concentration across the membrane, and could result in producing a gravitational response through initiating a cascade of bioelements. Vacuolar movement might serve to tighten rigid, spectrin-like linkers, should they exist between the vacuole and cell membrane. Our purpose here has been to investigate the existence and localization of spectrin and actin using immunohistochemistry. A new electron microscopy method for elucidating cytoskeletal elements using a removable embedding media, diethylene glycol distearate, is also being attempted.

**2:15 CHEMISTRY AND PHYSIOLOGY OF AN INDUCED PLASMA MEMBRANE CELL FUSION RECEPTOR IN THE MYXOMYCETES, *DIDYMIUM IRIDIS*.** Scott J. Howell and John J. Yemma, Biology Dept., Youngstown State University, Youngstown, OH 44555.

Cellular fusion is a relatively poorly understood phenomenon. Our efforts to help elucidate membrane components involved in cellular fusion have led us to utilize a model system consisting of haploid myxamoebae of the species, *Didymium iridis*. Myxamoebae have shown an ability to undergo fusion with cells of the opposite mating type upon obtaining a critical cell density of  $1 \times 10^5$  E+5 cells/ml. At this critical density, myxamoebae produce a substance similar to trisporic acid, that induces the plasma membranes of the cells in such a way as to allow fusion to occur. The resultant fusion yields diploid zygotes which later give rise to free flowing plasmodia. Our research centers on the differences shown between the plasma membrane proteins of the induced (competent to fuse and mate) and the uninduced (incompetent to fuse and mate) haploid myxamoebae. Our laboratory has made antibodies against the induced myxamoebae. Isolated plasma membranes used in conjunction with the aforementioned antibodies have allowed us to form Ab-cell surface protein complexes. Complex formation has been determined by HPLC, electrophoresis, and fluorescence microscopy. Examination of these complexes has allowed us to ascertain which cell surface proteins (glycoproteins) are apparently involved in the process of cellular fusion between haploid myxamoebae of *D. iridis*.

## 2:30 - 3:00 POSTER BREAK

**3:00 THE ABILITY OF SEVEN SUBSURFACE BACTERIA TO GROW IN THE PRESENCE OF FIVE XENOBIOTICS.** Christine H. Goray and Martha M. Kory, University of Akron, Akron, OH 44325-3908.

Soil subsurface bacteria were studied to determine if they are capable of growing in the presence of each of five xenobiotics. The ultimate goal of this study was to determine if any of the organisms were able to degrade a wide variety of xenobiotics. The seven bacteria were five Gram negative rods and two Gram positive rods. Of the Gram negative rods, three were species of *Pseudomonas* and two were unidentifiable non-fermenting Gram negative rods. Both of the Gram positive rods were probably species of *Arthrobacter*. The Department of Energy has identified a list of xenobiotics as possible contaminants in soil and ground aquifers. The five xenobiotics used in this study were p-xylene, toluene, quinoline, acridine and indole. This was a two part study. The first part was to grow the seven species separately in very rich peptone-tryptone-yeast extract-glucose medium (PTYG) with various concentrations of xenobiotic organic compound. The second part of the project involved growing the organisms in a nutrient poor xenobiotic-supplemented basal medium with a very small amount of glucose. In both media, organisms were incubated at  $23^\circ\text{C}$  for 48 to 60 hours with samples taken at 12 hour intervals. Growth was

detected spectrophotometrically. All bacteria grew in all concentrations of xenobiotic-supplemented PTYG. In general, the growth was much less in the basal medium with the xenobiotic. These organisms can grow in the presence of the xenobiotics. Perhaps the organisms could be used for in situ bioremediation of contaminated soil and ground water.

**3:15 INVESTIGATION OF RAPDs IN *LINUM USITATISSIMUM* (FLAX).** Milica Parojic and Mark Gorman, Biology Dept., Baldwin Wallace College, Berea, OH 44017.

The goal of this investigation was two-fold. First to establish a working protocol for the discovery of random amplified polymorphic DNAs (RAPDs). This was done to insure the consistency of data. Second, data was to be collected to contribute to a pre-established, yet incomplete, genomic map of Flax (*Linum usitatissimum*). Preliminary work with RAPDs was inconsistent and unreliable. Problems were due to concentration errors of the F2 DNA and difficulties in the polymerase chain reaction (PCR) protocol, as well as with the electrophoresis technique. However, this preliminary work led to the development of a working protocol which yielded fast and reliable data. The data collected from this investigation included the discovery of 14 RAPDs which were integrated into the preestablished genomic map by studying the cosegregation of RAPD markers with other genetic markers.

**3:30 USE OF RAPDs FOR GENOMIC MAPPING OF *LINUM USITATISSIMUM* (FLAX).** Colleen Kloczek, Michael Reep and Mark Gorman, Biology Dept., Baldwin-Wallace College, Berea, OH 44017.

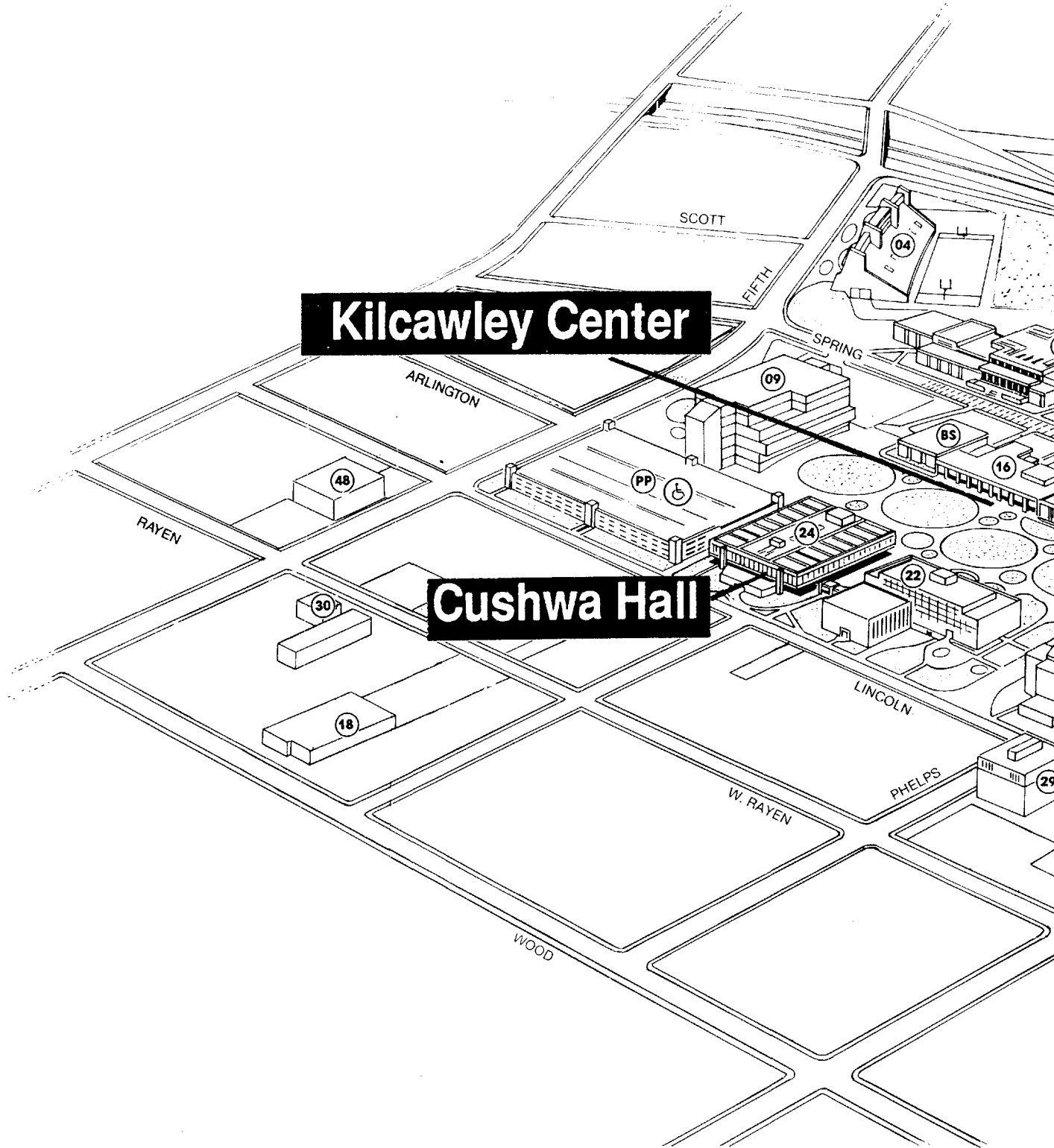
The purpose of this research was to obtain new genetic markers to facilitate the development of a genomic map for flax. The type of markers used were Random Amplified Polymorphic DNA (RAPDs). A flax map was initiated at Baldwin-Wallace using restriction fragment length polymorphisms (RFLPs) and traditional markers. However, since RFLPs are difficult to work with and since many markers are needed to generate a well saturated map, we have begun to add RAPDs. No other group is currently doing mapping in flax despite its being a significant global crop with an extremely diverse product market. This includes industrial uses (paint, linoleum, etc.), a high nutritional value and use in textiles (linen). These markets may be enhanced by using a map for selective breeding. Mapping of unique flax genes such as those for rust-resistance and genomic-plasticity also may facilitate the engineering of other crops with genes isolated from flax. Segregation data were collected for 14 RAPDs in an initial study, while we collected data for 27 additional RAPDs for a total of 41. Several of these RAPD markers have been mapped to linkage groups, but most of them have been found to segregate independently with the data collected to date. This research is ongoing as more markers are being discovered and additional segregation data collected.

**3:45 pVA517C: A POTENTIAL, AMPLIFIABLE *E. COLI* VECTOR.** E. EwJeanne Argus and L. Glatzer, Dept. of Biology, The University of Toledo, OH 43606.

The characteristics of a potential new *E. coli* cloning vector have been investigated in order to develop a new gram positive/gram negative shuttle vector. The marker-free plasmid (pVA517C), derived from a strain traditionally used as a ccc size standard, is multicopy and highly amplifiable (chloramphenicol) and its 5.7 Kb size justifies expanded characterization and development in the form of restriction mapping and insertion of selectable markers. The plasmid has numerous useful single and double restriction sites and does not restrict with other common restriction enzymes such as EcoRI, PstI, HindIII, and SalI. These major fragments which are generated by HaeII cleavage were used in a shotgun subcloning protocol with a 1.4Kb HaeII kanamycin resistant (Km<sup>R</sup>) fragment isolated from pACYC177. Evaluation of a 2.7 Kb Km<sup>R</sup> transformant indicates that the pVA517C replication origin is located on the 1.3 Kb HaeII fragment along with several single restriction sites. Recovery of a Km<sup>R</sup> subclone containing the two largest HaeII fragments is currently underway.

**4:00 CHARACTERIZATION OF CONJUGAL TRANSFER OF AMINOGLYCOSIDE RESISTANCE PLASMID pTo105 IN STAPHYLOCOCCUS.** S. McGregor and L. Glatzer, The University of Toledo, Toledo, OH 43606.

In filter membrane matings using strain R839 containing the plasmid pTo105, several characteristics of conjugation in *Staphylococcus* have been elucidated. It has been determined that washing the donor with broth prior to mating has no effect on transfer frequency. Also, preincubation of the cells in, and subsequently mating in the presence of 1mM EDTA did not affect frequency of transfer. By bringing the donor and recipient together on a membrane, and subsequently resuspending 90% of the cells, transfer frequencies of the order  $10^{-4}$ /recipient were obtained within two hours. In the absence of a membrane resuspension step, frequencies of  $10^{-6}$ /recipient are typical. It is important to note that another *Staphylococcus* strain F10192 containing plasmid pTo117 has also exhibited high frequency transfer as a result of resuspension enrichment. In "early transfer" experiments transconjugants have been witnessed after several minutes. From this date we may speculate that there are no loosely associated membrane factors on the donor that affect mating, and conjugation is not reliant upon divalent cations. Also, transfer may only occur between the most closely associated cells on the membrane since frequencies are maximized at  $10^{-4}$ /recipient. Finally, because resuspension inhibits transfer in cells not



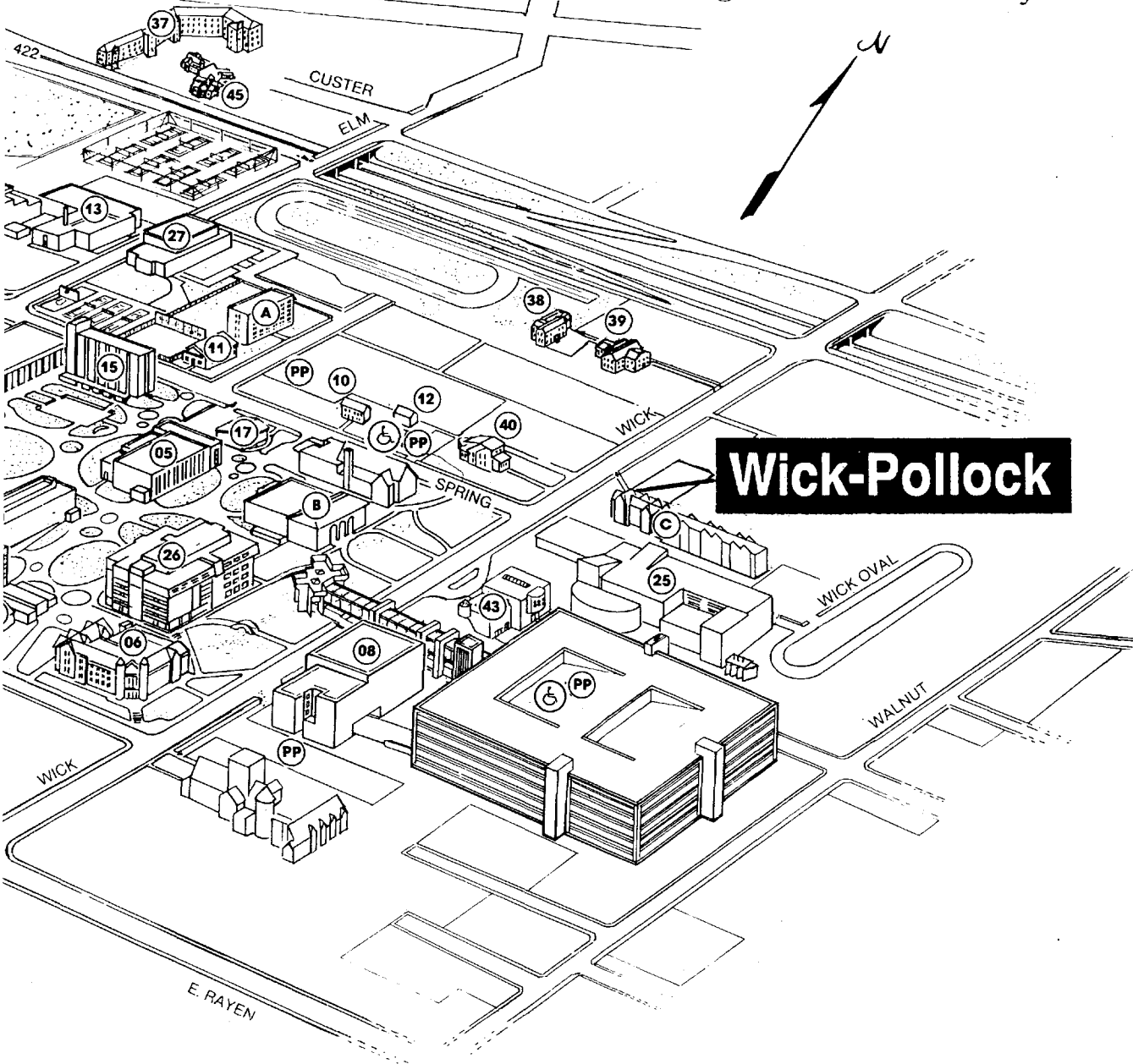
## BUILDING NUMBERS

|                                  |    |                               |    |
|----------------------------------|----|-------------------------------|----|
| Alumni House.....                | 40 | Coffelt Hall.....             | 10 |
| Beeghly Center.....              | 01 | Cushwa Hall.....              | 24 |
| Bliss Hall.....                  | 25 | Dana Hall.....                | 11 |
| Bookstore.....                   | BS | DeBartolo Hall.....           | 09 |
| Campus Police Bldg.....          | 12 | Engineering Science Bldg..... | 22 |
| Central Receiving/Warehouse..... | 18 | Fedor Hall.....               | 13 |
| Central Services Bldg.....       | 17 | Grounds Bldg.....             | 41 |
| Central Utility Plant.....       | 27 | Grounds Office.....           | 30 |
| Christman Dining Commons.....    | 45 | Jones Hall.....               | 06 |
|                                  |    | Kilcawley Center.....         | 16 |

IN AVENUE

# YSU Campus Map

Youngstown State University



**Wick-Pollock**

|                          |    |
|--------------------------|----|
| Kilcawley House          | 15 |
| Lyden House              | 37 |
| Maag Library             | 26 |
| McDonough Museum of Art  | 43 |
| Meshel Hall              | 08 |
| Office Annex             | 34 |
| Planetarium              | P  |
| Public Parking           | PP |
| Public Service Institute | 48 |
| Stambaugh Stadium        | 04 |

|                          |    |
|--------------------------|----|
| Tod Administration Bldg. | 05 |
| Ward Beecher Hall        | 14 |
| Weller House             | 38 |
| Wick House               | 39 |
| Williamson Hall          | 29 |

## NON-UNIVERSITY FACILITIES

|                                  |   |
|----------------------------------|---|
| Buechner Hall                    | A |
| Butler Institute of American Art | B |
| Wick-Pollock Inn                 | C |

maintained on the membrane, the cells must be held in intimate contact while the conjugal process occurs.

4:15 EFFECT OF IRRADIANCE ON APICAL DOMINANCE. Morris G. Cline, Plant Biology Dept., The Ohio State University, Columbus, OH 43210.

There is a dramatic difference in the shoot morphology of Japanese Morning Glory (*Ipomoea nil*) plants grown inside growth rooms with artificial lighting as compared with those grown outside. The inside plants grow tall without branching whereas those outside are shorter but branch prolifically. We have hypothesized that this release of apical dominance in the outdoor plants is due to (1) the difference in the spectral quality of light emitted from the sun as compared to that from fluorescent/incandescent sources indoors or to (2) the greatly increased irradiance level of sunlight compared to that of indoor lighting. We tested the second hypothesis outside by the use of shade screens which presumably reduced the irradiance level without altering the spectral quality of the incoming solar radiation. This shading of the outside plants completely eliminated branching thus supporting the second hypothesis that the higher irradiance outside was responsible for the noted apical dominance release and also suggesting a carbohydrate nutritional role in this process.

4:30 ENVIRONMENTAL CONTROL OF A TRANSCRIPTIONAL ACTIVATOR IN MAIZE. Bernard C. Mikula, Defiance College, Defiance, OH 43512.

The *R* gene is a tissue specific transcriptional activator controlling pigmentation of maize kernels. Under conditions of paramutation the *R* gene can be made to show heritable change in expression when subjected to specific environmental conditions. A developmentally sensitive period of 1-6 days has been uncovered whereby temperature and light conditions, administered just prior to tassel determination, can impose heritable changes in *R*-gene expression. The change in gene expression is observed as a gametic tissue mosaic; the earliest gametes sampled are lighter than those produced by the same plant seven days later. The differences observed are statistically significant ( $P = .001$ ). Transposable elements associated with the *R* gene, a transcriptional activator, may provide a genetic transducing mechanism capable of converting environmental information into heritable epigenetic responses which could be adaptive.

4:45 ENVIRONMENTAL REGULATION OF PHOTOSYNTHETIC APPARATUS BIOGENESIS IN *RHODOBACTER CAPSULATUS*. Steven E. Lang and Monika Becker Rudzik, Dept. of Biology, Westminster College, New Wilmington, PA 16172.

The purple nonsulfur photosynthetic bacterium *R. capsulatus* regulates the synthesis of the photosynthetic apparatus in response to at least two environmental stimuli: oxygen tension and light intensity. This study explores the induction of the photosynthetic apparatus in response to different carbon sources with varying oxygen tension and light intensities. A single transcriptional unit called the *puf* operon encodes polypeptides that regulate transcription of the reaction center and the light harvesting proteins in *R. capsulatus* photosynthetic apparatus. A strain of *R. capsulatus* with a translational fusion of the *pufQ* to *lacZ* was used to measure the induction of the *puf* operon under various environmental conditions. Preliminary experiments indicate induction of the *puf* operon varies when cultures are grown aerobically in the following carbon sources: malic acid, glucose, and acetic acid. Carbon sources were also found to influence the lag in growth between aerobic and photosynthetic conditions.

## CLINICAL MEDICINE & NURSING

9:30 A.M., Saturday, May 1, 1993

Cushwa Hall 1098

Augusta Askari, Presiding

9:30 HEALTH CARE UTILIZATION IN AN UNDERSERVED RURAL INDIGENT POPULATION. Robert P. Onders, Rena Davis, Shelana Gibbs, Steve Gorsuch, and Chinyere Oralu, Kent State University, 429 Manchester Hall, 15 Eastway Dr., Kent, OH 44243.

The focus of this research is to examine the Anderson & Newman Model of Health Care Utilization for specific implications on an underserved rural indigent population. It was proposed that the unique characteristics of this group, their beliefs, and the characteristics of the health care resources available to them would influence their overall utilization of the health care system. A thirty-two item questionnaire was administered to a purposive sample at several locations. The study was done in a volunteer and anonymous interview format. The questionnaire was divided into several sections. The categories were used to operationalize personal characteristics, health care use, and health care attitudes. This was accomplished through the use of open and closed ended questions, Likert and interval scales along with some comparative rating scales. The sample consisted of forty-four individuals with characteristics similar to those found in the medically underserved population. Analysis of the data revealed that education was the only

significant variable that agreed with the Anderson & Newman Model of Health Care Utilization.

9:45 AIDS-SPECIFIC CURRICULUM EVALUATION COMPARED TO A 1989 AIDS SURVEY AT A MIDWESTERN UNIVERSITY. Judy L. Adams, Connie Schondel, and Glenn Shields, Dept. of Medical Technology, Bowling Green State University, Bowling Green, OH 43403.

Education regarding transmission of Human Immunodeficiency Virus (HIV) is essential to reduce increasing numbers of HIV positive persons and persons with Acquired Immunodeficiency Syndrome (AIDS). A curriculum at Bowling Green State University (BGSU) addresses HIV/AIDS knowledge, attitudes, and behavior; a comparison of the curriculum's effectiveness and a 1989 report indicates that college students are much better informed about AIDS/HIV, but their behavior modification to avoid "risky" activities has changed minimally. Students in the BGSU AIDS classes and control groups were asked to respond to questions pertaining to HIV/AIDS knowledge, attitudes, and behavior. Data indicated: television is less effective in HIV/AIDS education than school classroom programs and/or printed materials; smaller schools appeared to rely on handouts more than do larger schools; prior to college, students' information came from parents, peers, and the classroom; clergy/church appeared to play no role in disseminating HIV information. Of the sexually active, >10% had intercourse by age 14, 25% by 15, and nearly 1/2 by 16; these figures are significantly higher than those reported in a 1989 study from the same geographical area. About 1/2 of the students indicated not using condoms. Our data suggested: 1) sexual activity has increased dramatically without an increase in condom use; 2) willingness to discuss HIV/AIDS issues has increased; and 3) individual application of that knowledge to reduce risk is not forthcoming.

10:00 AN EDUCATIONAL PROGRAM INTEGRATING COMPUTER-ASSISTED INSTRUCTION AND CLINICAL SITUATIONS TO TEACH NEWBORN NUTRITION TO NURSING STUDENTS. Nancy Barkley Aho, The University of Akron, College of Nursing, Akron, OH 44325-3703.

The need to further educate parents about infant nutrition and feeding has been documented as a growing concern nationwide. Nurses and nursing students can assist in resolving this problem by placing greater emphasis on newborn nutrition when educating parents in the clinical setting. An educational experience that integrates information about nutrition for growth and development and principles related to infant feeding would prepare nursing students for their role in parent education. Such a program was developed to assist nursing students at one university. The educational program involved three components. First, to learn calculation of caloric requirements for newborns, students were required to complete faculty developed computer-assisted instruction. Second, experience comparing various commercial formulas, methods, and practices related to feeding was provided in a learning laboratory. Third, students, in collaboration with the nursing staff, were required to implement a teaching plan for parents about an aspect of infant nutrition. In addition, the clinical experience served as an opportunity for students to practice the calculation of Caloric and fluid needs for their assigned newborns. Increased knowledge about neonatal nutrition, greater confidence with parent education, and improvement with math calculations nursing students were expected outcomes that will be discussed, with implications for refining the educational program.

10:15 RELIGIOSITY AND ATTITUDES TOWARD THE ELDERLY AMONG NURSE ASSISTANTS EMPLOYED IN NURSING HOMES. Dorothy Blackmon, University of Akron, Dept. of Sociology, Olin Hall, Akron, OH 44325-1950.

Nurse assistants' attitudes toward the elderly in relation to religiosity is assessed using a sample of nurse assistants in the Ohio Teaching Network program. Over 70 percent of the nurse assistants indicated religion was very important or somewhat important in their lives. The extent religiosity influences the nurse assistants' care of the elderly is examined in this study.

10:30 MEASUREMENT OF ATTACHMENT USING HEART RATES. Marlene S. Huff, The University of Akron, College of Nursing, Akron, OH 44325-3703.

Heart rate as a function of the psychological state was studied in relation to mother-infant attachment which is generally assessed through observable behaviors. A more objective assessment would be helpful to validate this process. Postulating that heart rate varies with the emotions that affect mother-infant interaction, a descriptive study was used to learn more about heart rates in a dyadic situation and determine the relationship between the heart rates shortly after birth. Thirty mother-infant dyads were monitored with Hewlett-Packard heart monitors for 15 minutes of uninterrupted time together within 72 hours following birth. All subjects were in good health and required no deviation from routine hospital care. Heart rates were initially recorded every 20 seconds in average rates per minute. The data were collapsed into 5 minute segments of time and recorded as average rate per minute for each 5 minute segment. The mothers' mean heart rate remained fairly constant during the 15 minutes ranging from 87.35 (SD 12.7) to 87.48 (SD 12.5). The infants' mean heart rate increased slightly as did the standard deviation, ranging from 118 to 119.84 (SD 13.56 - 20.41). A paired t-test showed no significant difference between times 1 and 3 for either mother or infant. The Pearson-Product Moment test was used to determine relationships between the mothers' and infants' heart rate; no statistical



relationship was found. Results indicate that a more sensitive way of measuring heart rate would be necessary to recognize the potential subtle change or condition that may be a component of attachment.

**10:45 IDENTIFICATION OF *LEISHMANIA* PARASITES FROM DESERT STORM PARTICIPANTS AND A GENETIC COMPARISON WITH OTHER OLD WORLD ISOLATES.** R.D. Kreutzer, A. Magill, F. Neva, D.J. Fryauff, M.M. Aleman-Munoz and M. Grogil, Biology Dept., Youngstown State University, Youngstown, OH 44555; Walter Reed Army Medical Center, Washington, D.C.; Lab of Parasitic Diseases, NIAID, NIH, Bethesda, MD; USNAM Research Unit, Cairo, Egypt; Medical School, University of Panama, Republic of Panama.

*Leishmania* parasites were isolated from U.S. military participants in Desert Storm. A partial list of the isolates we have cultured, identified by enzyme electrophoresis and cryopreserved includes 7 *L. tropica* (LT) and 6 *L. major* (LMJ). A complete enzyme analysis was made of these 13 as well as 19 LT and 31 LMJ isolates from Africa and the middle east. Most human hosts of the 19 LT group had simple cutaneous leishmaniasis, but the Desert Storm LT patients presented with viscerotropic disease. Data will be included reporting clinical forms in all human hosts as well as enzyme data noting the LT isolates are on average twice as polymorphic at the 10 and 20% levels than are the LMJ isolates. There are only minor enzyme differences (2 enzymes) among the LMJ Desert Storm isolates. Among the 7 LT isolates there are 2 or 3 distinct genetic (enzyme) types. Thus far LT and LMJ are the two *Leishmania* parasites which have been identified from U.S. Desert Storm participants. The LT parasites are significantly more polymorphic than are the LMJ parasites which is also the case with other isolates of these two parasites.

## MEDICAL PHYSIOLOGY

**1:30 P.M., Saturday, May 1, 1993**

**Cushwa Hall 1098**

**Daniel Ely, Presiding**

**1:30 THE HYPERTENSIVE Y CHROMOSOME ELEVATES BLOOD PRESSURE IN NORMOTENSIVE RATS SOCIALLY INTERACTING IN A COLONY USING CONTINUOUS BLOOD PRESSURE MONITORING BY TELEMETRY.** Ann Caplea, Gail Dunphy, Hamid Daneshvar, Monte Turner, and Daniel Ely, Dept. of Biology, The University of Akron, Akron, OH 44325-3908.

The primary technique for measuring blood pressure (b.p.) in rodent studies has been via indirect tail sphygmomanometry. However, it is difficult to do behavioral and circadian rhythm studies with this technique. Therefore, the purpose of this experiment was to determine: 1) continuous b.p. in rats socially interacting, 2) if there was a Y chromosome hypertensive effect using 2 sub-strains of hypertensive rat, and 3) if there was a genetic b.p. variation in relation to the light/dark cycle. Two new substrains, SHR/a and SHR/y were compared to SHR and WKY. The territorial colonies were on a high sodium (3%) diet for 15 weeks. Continuous b.p. measurements were taken using aortic radio-telemetry (Data Sciences). For comparison, b.p.s were also taken weekly using either a tail cuff or catheter. The hypertensive Y chromosome (SHR/y substrain) increased b.p. to the same extent as the hypertensive autosomes. Also, tail catheter b.p. taken simultaneously with indirect tail b.p. significantly correlated ( $r=0.80$ ,  $p<.01$ ). Telemetered b.p. also highly correlated ( $r=.93$ ,  $p<.001$ ) with indirect weekly tail cuff b.p. All strains demonstrated higher b.p. during the dark cycle when compared to the light cycle. In conclusion, telemetered b.p. can be done in a colony and the hypertensive Y chromosome increases b.p. in a normotensive genetic background.

**1:45 THE Y-CHROMOSOME FROM SPONTANEOUSLY HYPERTENSIVE RATS (SHR) RAISES RESTING AND STRESS BLOOD PRESSURE SIMILAR TO HYPERTENSIVE AUTOSOMAL COMPONENTS USING AORTIC TELEMETRY.** Gail Dunphy, Cathleen Jenkins, Monte Turner and Daniel Ely, Dept. of Biology, The University of Akron, Akron, OH 44325-3908.

This study examined the blood pressure (b.p.) responses in the SHR, Wistar-Kyoto rat (WKY) and two F11 hybrids under acute stress conditions. The two hybrid crosses were bred in our lab to produce males with a Y chromosome from a hypertensive father and normotensive autosomes (SHR/y) or the reciprocal cross producing a male with a normotensive Y chromosome and hypertensive autosomes (SHR/a). To determine 24 hr b.p. a radio-telemetry catheter was inserted into the descending aorta and the transmitter was sutured into the abdomen. The rats could move freely with no external hardware and b.p., heart rate and activity were transmitted and stored in a computer-based data acquisition system. The rats consumed a high salt diet (3% Na). Animals were stressed using: intruders, air puff to the face, norepinephrine injection, and the presence of squealing pups. The baseline b.p. was significantly higher ( $p<.001$ ) in both substrains as compared to the WKY rat. In all stresses, except the pup stress, SHR/a, and SHR/y had similar and significantly higher ( $p<.001$ ) b.p. stress responses than that of WKY. These data support our hypothesis that hypertension in the SHR has two components, an autosomal component, and a Y-linked component that confers hypertensive stress responsiveness which was

prevented by an alpha receptor blocker. (This research was supported by Natl. AHA and Ohio Board of Regents grants.)

**2:00 THE EFFECT OF AROMATASE INHIBITOR TREATMENT IN NEONATALLY SPONTANEOUSLY HYPERTENSIVE RATS ON THE DEVELOPMENT OF HYPERTENSION IN ADULTS.** Don Molnar, Ronald Salisbury, and Daniel Ely, Dept. of Biology, The University of Akron, Akron, OH 44325-3908.

The objective of the following study was to determine if preventing masculinization of the brain in males would reduce the high blood pressure in spontaneously hypertensive rats (SHR). In the male brain aromatase converts testosterone to estrogen which results in the masculinization of the male brain. We looked at the effects of neonatally blocking the action of aromatase on development of hypertension in the adult SHR rats. Male SHR pups were placed into two groups of 12 with 6 to a mother. At day 3 the experimental group received injections of aromatase inhibitor androstatrien-3, n-dione (ATD) in propylene glycol. The control group received injections of propylene glycol. This procedure continued until day 6. At week 5 blood pressures were taken by tail sphygmomanometry and body weights were recorded. This procedure continued on a weekly basis until week 12. At the 12th week there was no significant difference in the blood pressures between the experimental group at 154 mmHg and control group at 158 mmHg. This suggests that blocking estrogen production from day 3 to day 6, which is the time the brain becomes masculinized, does not decrease the development of hypertension in adult SHR rats. (This research was supported by: Natl AHA and Ohio Board of Regents grants.)

**2:15 THE HYPERTENSIVE Y CHROMOSOME INFLUENCES TESTOSTERONE LEVELS IN NORMOTENSIVE AND HYPERTENSIVE RATS.** Jessica Faivo, Gail Dunphy, Monte Turner, and Daniel Ely, Dept. of Biology, The University of Akron, Akron, OH 44325-3908.

Our laboratory has shown that hypertension is linked to the Y chromosome and is suspected to be influenced by testosterone. This research attempts to determine the relationship between testosterone and blood pressure (b.p.) during the rapid development phase of b.p. rise in 4 strains of rats: 1) WKY, a normotensive strain, 2) SHR, a spontaneously hypertensive strain, 3) SHR/y, a strain receiving the Y chromosome from an SHR father and autosomes from a WKY normotensive mother, and 4) SHR/a, a cross receiving its autosomes from the SHR female and the Y chromosome from a normotensive father. Beginning at 5 weeks of age, blood samples were taken via retroorbital puncture on alternating weeks with b.p. Testosterone was measured using a radio immunoassay. During the critical phase of b.p. rise, between 6 and 8 weeks, there was a rise in serum testosterone in all strains. In SHR and SHR substrains testosterone increased from about 3-27 pg/dl and b.p. went from 121-157 mmHg. However, the WKY testosterone range was 6.5-12.1 pg/dl with a b.p. rise from 124-139 mmHg. In conclusion, testosterone may influence blood pressure during the critical phase of rapid body growth and blood pressure rise. (This research was supported by grants from the National American Heart Assoc. and Ohio Board of Regents.)

**2:30 PULMONARY HYPERTENSION AND PLATELET FUNCTION.** Ding C. He and Li Y. Hou, Institute of Surgical Cardiovascular Disease, The First Xian Medical University Hospital, Xian City, Shaanxi Province 710061, People's Republic of China.

Platelet number and function were measured in 45 patients with congenital heart disease, who aged between 5 and 49 years and underwent open-heart surgery with cardiopulmonary bypass (CPB). The study showed that platelet adhesion and aggregation were higher in the patients with pulmonary hypertension (experimental group) than in those without pulmonary hypertension (control group). Platelet number and function gradually increased in the experimental group after operation and post operational blood loss was greater than that in the control group. The reason for this might be low ratio of prostacyclin I2 to thromboxane A2, which caused platelet hyperfunction. The hyperfunctional platelets could easily be destroyed and removed during CPB and would reduce post operational platelet number and function and increase post operational blood loss. We suggest that ascorbic acid, aspirin, and other antiplatelet drugs should be administered preoperatively to alleviate platelet destruction; hemostasis should be checked during operation to reduce blood loss as much as possible; hemostatic mechanism and respiratory management must be carefully monitored after operation; and an infusion of fresh blood and platelet should be carried out to promote the recovery of platelet number and function. Further research will be concentrated on the relationship between the degree of pulmonary hypertension and the level of prostacyclin I2 and thromboxane A2.

**2:45 LONG-TERM (24 HOUR) RAT HEART PRESERVATION USING AN IRON CHELATOR-ZINC-HISTIDINE.** D. Petrinec, G. Dunphy, L. Zawiski, and D. Ely, Dept. of Biology, The University of Akron, Akron, OH 44325-3908.

During 24-hour in vitro heart preservation and subsequent reperfusion, irreversible tissue damage occurs caused by reactive oxygen intermediates. Prevention of hydroxyl radical production and the related oxidative damage of reperfused ischemic tissue by free radical scavengers are of primary importance in maintaining heart function. We examined the dose-response effect of zinc histidine added to a cardioplegia solution in an attempt to maintain 80-

90% heart function in the Langendorff isolate rat heart model perfused at 5°C for 24 hours. A group (n=10) of hearts from male spontaneously hypertensive rats were perfused with our enhanced cardioplegia and served as controls. Four other heart groups had zinc histidine added to the cardioplegia: 50 µm/L (n-3), 100 µm/L (n-4), 200 µm/L (n-4), 400 µm/L (n-4). The control hearts were better in all parameters than the zinc-histidine group. Creatine kinase was increased 233% at 50 µm/L ( $p < 0.01$ ), 145% at 100 µm/L ( $p = 0.04$ ), 140% at 200 µm/L ( $p = 0.026$ ), and 263% at 400 µm/L ( $p < 0.01$ ). The coronary flow was 32% less at 50 µm/L ( $p = 0.002$ ), 16% less at 100 µm/L ( $p = 0.044$ ) and 28% less at 400 µm/L ( $p = 0.003$ ) than controls. The systolic pressure was 26% less at 50 µm/L ( $p = 0.002$ ) and 21% less at 20 µm/L ( $p = 0.016$ ) than controls. This data suggests that zinc histidine was not an effective in preventing iron mediated damage for long-term heart preservation.

### 3:00 - 3:30 POSTER BREAK

**3:30 HIGH SODIUM AND TESTOSTERONE TREATMENT INCREASE BLOOD PRESSURE SIMILAR TO MALES IN OVARECTOMIZED SPONTANEOUSLY HYPERTENSIVE FEMALE RATS (SHR).** Linda Zawiski, Ron Salisbury and Daniel Ely, Dept. of Biology, The University of Akron, Akron, OH 44325-3908.

It is known that essential hypertension is more prevalent in males than in females. To isolate the mechanism for this sexual difference, we examined at the role of the androgens, and estrogens in the development of hypertension. Four groups of SHR females were analyzed in a 2x2 factorial design. Experimental groups were: (I) intact ovaries and sham implants; (II) ovariectomized and sham implants; (III) intact ovaries and testosterone implants; (IV) ovariectomized and testosterone implants. A11 groups were fed a high sodium (3%) diet in order to potentiate a rise in blood pressure (b.p.) which was measured weekly by tail cuff sphygmomanometry for twelve weeks. Clonidine, a sympathetic nervous system blocker, was given to the testosterone implanted groups during weeks 10 and 11. Overall, the groups receiving testosterone maintained significantly higher b.p. ( $p < .01$ , ANOVA). The group with the highest b.p. was group IV, which had testosterone, but not estrogen. The group with the lowest b.p. was group I, which had estrogen, but no testosterone. In conclusion, testosterone, in combination with high sodium, had a direct and significant impact on the development of hypertension. (This research was supported by a National AHA grant and an Ohio Board of Regents Academic Challenge Grant.)

**3:45 A HIGH SODIUM DIET AND TERRITORIAL STRESS ELEVATE BLOOD PRESSURE THROUGH AUTOSOMAL AND Y-LINKED GENETIC COMPONENTS IN HYPERTENSIVE RATS.** Hamid Daneshvar, Monte Turner, and Daniel Ely, Dept. of Biology, The University of Akron, Akron, OH 44325-3908.

The objective of this study was to compare the genetic components of hypertension in the SHR with high sodium diet and territorial stress. We have developed two new congenic substrains. The first substrain has 99% SHR autosomal genes and a WKY Y chromosome (SHR/a strain) and the second has 99% WKY autosomal genes and a SHRY chromosome (SHR/y strain). SHR/a, SHR/y, and SHR males (n=10/group, 6 wks of age) were placed in a colony with females of same strain (n=10/group). All animals were placed on high Na (3% Na) at 6-16 weeks of age and exposed to territorial stress. Blood pressure was measured weekly using the tail cuff technique. SHR/a males had significantly higher B.P. compared to: 1) WKY males (170 vs 143 mmHg  $p < .001$ ), and 2) SHR/y males (170 vs 154  $p < .017$ ). These data suggest that under high stress and high Na conditions both autosomal and Y chromosome loci increase blood pressure significantly compared to that of the WKY. In our study we also looked at a group of pure SHR (n=8) which had even higher B.P. compared to both SHR/a and SHR/y (185 vs 170 vs 143  $p < .027$ ). In conclusion, the autosomal chromosomes and the hypertensive Y chromosome both significantly increase B.P. under high stress and high Na conditions as compared to WKY. (Supported by grants from the Ohio Affiliate of the AHA and Ohio Board of Regents.)

**4:00 INCREASED COLLAGEN CONTENT IN THE MYOCARDIUM OF HYPERTENSIVE RATS COMPARED TO NORMOTENSIVE RATS USING A MODIFIED CELL MACERATION/SCANNING ELECTRON MICROSCOPE (SEM) METHOD.** Douglas Chonko, Stanley Rittger, and Daniel Ely, Depts. of Biology and "Biomedical Engineering, The University of Akron, Akron, OH 44325-3908.

The objective of this study was to quantify the collagen fibrillar network in the left ventricular myocardium using several rat strains and different living conditions (high stress and high sodium). A modified cell-maceration/scanning electron microscope method of Ohtani (1988) was used. Tissue plugs from the left ventricle were immersed in 10% NaOH for 56 days followed by a water rinse (3 days) which removed the cellular elements and exposed the collagen matrix in its natural location. SEM photomicrographs were taken, videotaped, and processed using an image analysis software program (Global Lab) to quantify the density of collagen (pixel counts). There was a significant difference in the density of collagen between the spontaneously hypertensive rat (SHR) and the Wistar Kyoto (WKY) rat under a normal sodium (Na) and low stress conditions (82 vs 60,  $p < .05$ ). A high Na diet and high stress caused a significant increase in collagen density as compared to their controls on a normal Na diet and low stress in SHR/y, SHR/a, and SHR

(92 vs 64, 87 vs 58, 97 vs 82,  $p < .01$ ,  $p < .01$ ,  $p < .05$ , respectively). In conclusion, a high stress and a high Na diet produced a significant increase in collagen density in the SHR, SHR/y and SHR/a rat strains. (Supported by grants from the Natl. AHA and Ohio Board of Regents.)

**4:15 ATHEROGENIC BEHAVIORS OF CAFFEINE USERS.** Crystal D. Ricketts, University of Cincinnati, Dept. of Health and Nutrition Sciences, 435 Teachers College, ML 22, Cincinnati, OH 45221-0022.

Recent reports suggest that the use of caffeine is associated with increased serum cholesterol and triglyceride concentration. This study examined the association between caffeine intake and selected atherogenic behaviors in adults. Caffeine users consumed more saturated fat and cholesterol, were more likely to be current smokers and less likely to be current exercisers than were non caffeine users. Exercise also showed a dose response relationship to the amount of caffeine consumed. These data illustrate the clustering of atherogenic behavior with caffeine users and emphasize their potential importance in interpreting the literature about caffeine and health.

**4:30 EVIDENCE OF HYPERPLASIA AND HYPERTROPHY OF THE EPITHELIAL CELLS OF THE ANTERIOR PITUITARY IN TESTICULAR FEMINIZED MALE HYBRIDS.** Susie Holiday, Disha Hadi, Daniel Ely, and Ron Salisbury, Dept. of Biology, The University of Akron, Akron, OH 44325-3908.

Previous work in our laboratory has shown that the pituitary of the testicular feminized male was significantly larger than that of normal male siblings (4.5 vs 2.5 mg/100g body weight,  $p < .01$ ). Testicular feminized (Tfm) rats are insensitive to androgen and, therefore, may be used to observe the role of the androgen receptor and the effect it has on the microanatomy of the pituitary gland. We compared histological differences in Tfm rats (n=10) and normal sibling (n=10) anterior pituitary glands. Male hybrids (15 weeks of age) were used from an F1 cross of male SHR with female King-Holtzman who carried the androgen receptor deficiency trait. The pituitaries were embedded in plastic and stained with basic fuchsin and methylene blue. This stain was used to identify the acidophils and basophils. We observed hypertrophy in the cells of Tfm rats, as well as an abnormal increase in the number of cells. Normal pituitary glands had numerous sinusoid like cavities which were absent in the Tfm pituitaries. The defective androgen receptor in the Tfm appears to enhance growth and development of epithelial cell in the anterior pituitary gland, which may be due to a lack of feedback inhibition.

**4:45 COLLAGEN DEPOSITION INDUCED BY STRESS AND HIGH SODIUM IN CORONARY ARTERIES OF SPONTANEOUSLY HYPERTENSIVE RATS (SHR).** Debbie Steidl, Monica Moore, Linda Zawiski, Douglas Chonko, Geoffrey Caplea, Bryon Boulton and Daniel Ely, Dept. of Biology, The University of Akron, Akron, OH 44325-3908.

During the past two years our laboratory has examined the link between hypertension and increased collagen synthesis in the SHR. It remains unclear if collagen deposition is caused as a result of increased hypertension or if increased hypertension is the result of collagen deposition. The objectives were to histologically examine male coronary artery collagen deposition induced by: 1.) high sodium (3% Na, n=10) as compared to controls (0.3% Na, n=8), and 2.) caging inducing territorial stress (n=10) as compared to standardized caging (n=10). Animals were placed upon a high Na diet or control diet from 5-15 weeks of age. Upon termination, the heart was fixed in 10% buffered formalin, and tissues prepared for paraffin embedding and stained with a collagen-specific stain, Sirius Red. Coronary collagen was quantified by image processing software. High Na male SHRs showed increased collagen deposition in coronary arteries as compared to control Na males. Territorial stress and high Na treatment did not significantly affect collagen deposition as compared to high Na alone or standardized housing and high Na. In conclusion, high Na treatment increased coronary artery collagen deposition in a genetically hypertensive rat model more than in controls in spite of similar blood pressure between groups. (Supported by a Natl. AHA Grant and an Ohio Board of Regents Academic Challenge Grant.)

## MEDICAL SCIENCES & NUTRITION

**1:30 P.M., Saturday, May 1, 1993**

**Cushwa Hall 1104**

**Kelly Kohls, Presiding**

**1:30 EXCRETION OF METALS IN LEAD POISONED RATS TREATED WITH 2,3-DIMERCAPTOPROPANE-1-SULFONATE (DMPS)** Michael Lust, and Martha Kreimer-Birnbaum, St. Vincent Medical Center, 2213 Cherry St., Toledo, OH 43608.

Excessive body burden with lead is still a significant health problem. Chelating agents are available for treatment of lead poisoning, but improved drugs are needed, especially those that may be given orally. One such drug is DMPS. Rats were given 200 µg/ml lead acetate in drinking

water (LP group), while controls received water. Both groups received three-five day courses of DMPS (50  $\mu\text{mol/kg b.w./day}$ ) and urines were collected for analysis of metals. Our previous studies of Pb excretion following DMPS showed this agent to be promising. A study of the concomitant excretion of boron, calcium, copper, iron, magnesium, manganese, and phosphorus showed no differences between the LP and the control groups. However, copper excretion increased significantly during each of the three DMPS treatments ( $p < 0.0001$ ) in both groups. After each DMPS treatment, copper excretion returned to pre-treatment levels. The other six metals showed no significant variations in excretion patterns. Thus, there appears to be no irreversible alterations in metal excretion and no obvious metabolic threat to the animals undergoing the chelation process. Repeated low doses of DMPS may be an effective therapy for lead poisoning. (Supported in part by the F. M. Douglass Foundation.)

**1:45 CALCIUM BIOAVAILABILITY: EFFECT OF FOODS IT IS CONSUMED WITH.** Kelly J. Kohls, Family and Consumer Sciences Dept., Miami University, 260 McGuffey Hall, Oxford, OH 45056.

Two consecutive studies were conducted utilizing young healthy adults. Subjects were fed a controlled diet (basal diet) for five weeks and collected all urine and fecal samples for the duration of these projects. This study utilized a randomized complete block design. Study A subjects consumed a basal diet plus one of four different calcium fortified food products or a calcium supplement. The fortified foods used in this study were; diet soda, milk, cheese and orange juice. Study B subjects consumed a basal diet plus orange juice fortified with one of five forms of calcium ( $\text{CaCO}_3$ ,  $\text{Ca}_3(\text{PO}_4)_2$ , Ca lactate, Ca Gluconate, or CCM). Results of study A indicate calcium balance was best when subjects were fed calcium fortified orange juice. Results of study B indicate calcium balance as a percent of intake improved when subjects consumed any of the calcium supplements added to orange juice with the most dramatic improvement noted with  $\text{Ca}_3(\text{PO}_4)_2$ .

**2:00 CALCIUM BIOAVAILABILITY: THE MOUSE VERSUS THE HUMAN MODEL IN EXPERIMENTATION.** Kelly J. Kohls, Family and Consumer Sciences Dept., Miami University, 164 McGuffey Hall, Oxford, OH 45056.

Animal models have routinely been utilized for measuring calcium bioavailability. Two studies were conducted which measured calcium bioavailability of several different commercially available calcium supplements. Study A utilized humans as subjects. Subjects were fed a controlled diet (basal diet) plus one of seven calcium supplement forms fed at a level of 1200 mg/day. All urine and feces were collected during the study. Calcium balance was poorest when subjects consumed calcium carbonate -29mg/day versus the other calcium supplement forms 77-385 mg/day. Study B was conducted utilizing retired breeder mice which were fed a nutritionally complete diet fortified with the same forms of calcium utilized in the human study at .6% of the diet. All urine and Fe Cal samples were collected during the study. Results of study B indicate that calcium balance was more positive when mice consumed calcium carbonate 5.20 mg/day versus the other calcium forms given 1.86 - 4.92 mg/day. These two studies run back to back utilizing the same forms and brands of calcium supplements demonstrate a lack of reliability of the mouse as an experimental model for human calcium bioavailability.

**2:15 INFLUENCE OF MATERNAL INGESTION OF ACROLOR® 1254 (PCB) ON BODY TEMPERATURE AND OXYGEN CONSUMPTION IN YOUNG RATS.** Byung-Woun Seo, Lee A. Meserve, and Elizabeth Jacobs, Dept. of Biological Sciences, Bowling Green State University, Bowling Green, OH 43403.

Polychlorinated biphenyl (PCB) is an environmental pollutant linked to many physiological abnormalities, including behavioral modifications, hepatic carcinoma, and thyroid dysfunction. In rats of all ages thyroxine (T4) levels were shown to be depressed by PCB. Also, a depression in food consumption and body temperature can be attributed to thyroid dysfunction in adult animals. Because metabolic studies have not been conducted on neonatal rat pups exposed to PCB, this study compared the effect of two PCB doses on oxygen consumption ( $\text{VO}_2$ ) and body temperature of neonatal rat pups. The rat mothers were fed either 0, 125 ppm, or 250 ppm Aclorol® 1254 (PCB) by weight from the first day of conception through postnatal day 15. Litters were culled to 4 males and 4 females on day 3, and rectal body temperature and  $\text{VO}_2$  measurements were conducted on days 4-14. On day 15, the litters were sacrificed. Thyroid weights, body weights, and circulating thyroid hormone levels were determined. Final body weights were significantly depressed in a dose dependent manner, while thyroid weights (per 100 g body weight) did not differ. Levels of T4 were significantly depressed in both treatment groups, but triiodothyronine (T3) was unchanged. The rate of increase of body temperature and  $\text{VO}_2$  was depressed in the 125 ppm group compared to control, but not the 250 ppm group. There are several possible explanations for the compensation of these metabolic parameters. (1) activation of the arylhydrocarbon receptor and nuclear activation to enhance metabolic rate; (2) activation of brown adipose tissue to allow body temperature elevation; and (3) up-regulation of thyroid hormone receptors or increase in T4 to T3 conversion.

**3:30 CHEMICAL AND PHYSIOLOGICAL EFFECTS OF CANDIDA ALBICANS TOXIN.** Michael P. Berk and John J. Yemma, Biology Dept., Youngstown State University, Youngstown, OH 44555.

Today, with the prevalence of AIDS and other immunosuppressed patients, *C. albicans* specifically, has come to the forefront of medicine as the most common fungal pathogen. Once a human host's immune system becomes compromised, *C. albicans* begins to proliferate rapidly and is capable of causing the disease candidiasis (or candidosis) in virtually any tissue of the body. *C. albicans* may initiate a pathologic state under such circumstances as: physiological changes such as pregnancy, newborns that have not yet established a resident flora, invasive procedures, catheters, immunosuppressive therapy, malignancy, granulocytopenia, broad-spectrum antimicrobial agents, and especially the increased incidence of immune-deficiency diseases such as AIDS. Previous studies have determined that a potent toxin is produced by *C. albicans*. However, the extent of the tissue damage had not been assessed. Our research conducted thus far has shown that high infection and mortality rates can be achieved in laboratory rats using intraperitoneal inoculations of *C. albicans*. Also, other studies have shown that the intraperitoneal mode of infection results in numerous lesions on the kidneys, liver, and spleens of laboratory rats. Currently, we have compiled data from several experiments that analyzed the various proteins constituents within the plasma of infected rats and have correlated it with other experiments involving tissue damage.

**3:45 INHIBITION BY 1,25-DIHYDROXYVITAMIN D<sub>3</sub> OF INTERLEUKIN-2-STIMULATED HUMAN NATURAL KILLER CELLS.** D.L. Fagan and J.S. Adams, Dept. of Biological Science, Youngstown State University, 410 Wick Ave., Youngstown, OH 44555.

Natural killer (NK) cells are a sub population of human inflammatory cells that are distinct from monocyte/macrophages, T lymphocytes and lymphocytes. They act as a "first line of defense" against neoplastic and virus-infected cells. The current studies address this problem by examining the effect of the immunomodulatory hormone 1,25-dihydroxyvitamin D<sub>3</sub> [1,25-(OH)<sub>2</sub>D<sub>3</sub>] on a highly purified NK cell population. Peripheral blood mononuclear cells were purified by lack of adherence to plastic, passage through nylon wool and percoll density gradient centrifugation. The low density cells collected were 68% CD3 (non-T), 97% CD14 (non-macrophage) and 98% CD22 (non-B). Both interleukin-2-activated T cell and NK cell preparations exhibited cytotoxic activity (54% and 53% of total <sup>51</sup>Cr released, respectively) when incubated with K-562 target cells. However, NK mediated cytotoxic activity was markedly inhibited (40% of total <sup>51</sup>Cr) by incubation with 1,25-(OH)<sub>2</sub>D<sub>3</sub>, while T cell cytotoxicity was not affected. These results suggest 1,25-(OH)<sub>2</sub>D<sub>3</sub> inhibits NK cell function and could play a role in the regulation of the immune response to virus and neoplastic cells.

**4:00 ROLE OF INTERLEUKIN-1- $\alpha$  IN CUTANEOUS INFLAMMATION.** Andrew S. Oberyzy, Tatiana M. Oberyzy, Gautam N. Bijur, Carol L.K. Sabourin, Laszlo G. Boros and Fredika M. Robertson, Dept. of Surgery, The Ohio State University, Wiseman Hall, 400 W. 12th Ave., Columbus, OH 43210.

Although epidermal hyperplasia is a primary response during acute inflammation, the soluble mediators which regulate this process are not well defined. Interleukin-1- $\alpha$  (IL-1- $\alpha$ ) is a cytokine that induces proliferation of the structural cells within the skin, the epidermal keratinocytes. A murine model of cutaneous inflammation in which the dorsal epidermis of SENCAR mice was treated with 12-O-tetradecanoylphorbol-13-acetate (TPA) was used to examine the induction of gene expression of IL-1- $\alpha$  and to identify cells which either produce or proliferate in response to IL-1- $\alpha$ . A single topical application of TPA (2  $\mu\text{g}$ , 10  $\mu\text{g}$ ) induced a time and dose dependent stimulation of IL-1- $\alpha$  gene expression which was elevated at 15 min and peaked at 3-4 h. IL-1- $\alpha$  immunoreactive protein was localized within suprabasal keratinocytes following treatment for 1-22 weeks with TPA, however basal cells did not produce IL-1- $\alpha$  immunoreactive protein. Injection of IL-1- $\alpha$  specific antibodies (50  $\mu\text{g}$ ) via tail vein at 2 h prior to treatment of SENCAR mice with TPA (2  $\mu\text{g}$ , 10  $\mu\text{g}$ ) significantly ( $p < 0.05$ ) inhibited the proliferation of basal keratinocytes usually observed as early as 24 h following treatment with TPA. IL-1- $\alpha$  appears to be a pivotal cytokine which is produced by specific epidermal cells and primarily regulates proliferation of basal cells during inflammation in the skin.

**4:15 ANALYSIS OF PROTEIN KINASE C ISOTYPES IN K562 HUMAN ERYTHROLEUKEMIA CELL PROLIFERATION AND DIFFERENTIATION.** Gavin P. Baumgardner and Patrick McCarthy, Dept. of Biology, Westminster College, New Wilmington, PA 16172.

Earlier studies have shown that bryostatins 1 and phorbol myristate acetate, both protein kinase C activators, have differential biological effects on the K562 human erythroleukemia cell line. Phorbol myristate acetate has been found to arrest the growth of the cells and induce differentiation into megakaryocytic cells. Bryostatins, on the other hand, fails to arrest growth or induce differentiation. In addition, bryostatin 1 has been shown to block the effects of phorbol myristate acetate in simultaneous treatment. It has been hypothesized that the differential effects of these two compounds on the K562 cells is due to activation of certain isotypes of protein Kinase C by one compound and not the other. Current research investigated which of the isotypes are activated by bryostatin 1 and phorbol myristate acetate to cause the observed differential biological effects.

**2:30 - 3:30 POSTER BREAK**

## GEOHYDROLOGY

9:00 A.M., Saturday, May 1, 1993

Cushwa Hall 1105

Howard Lo, Presiding

9:00 CHARACTERIZATION OF A BURIED VALLEY AQUIFER: NORTH FORK OF THE LICKING RIVER, ST. LOUISVILLE, OHIO. M.P. Angle, M.P. Hallfrisch, R.J. Petty, P.N. Spahr, W. Jones, K.M. Storts, and D. Davis, ODNR, Div. of Water, 1939 Fountain Sq. Dr., Columbus, OH 43224.

The ODNR, Div. of Water, Ground Water Resources Section characterized the geology, hydrogeology, and water quality of the buried valley system underlying the North Fork of the Licking River near St. Louisville. Cross-sections were constructed from logs of 80 private wells, field observations, resistivity runs, and 15 test holes drilled by ODNR, Div. of Geological Survey. Water level data were obtained from private wells and from monitor wells installed in the test holes. Water samples taken from private wells, monitor wells and streams were analyzed for  $\text{NO}_3$ ,  $\text{NO}_2$ ,  $\text{NH}_3$ ,  $\text{SO}_4$ ,  $\text{Cl}$ ,  $\text{SiO}_2$ ,  $\text{SRP}$ , (Phosphorous) and specific conductance. Select samples were analyzed for  $\text{Ca}$ ,  $\text{Mg}$ ,  $\text{K}$ ,  $\text{Na}$ ,  $\text{HCO}_3$  and  $\text{Fe}$ , screened for pesticides, and scanned for presence of optical brighteners. A 72 hr pumping test, including stream-bed permeability measurements, was conducted at the Newark Wellfield to quantify hydraulic parameters. The impact, source, and transport of Non-Point Source (NPS) contaminants were evaluated for the aquifer system. Appropriate best management practices (BMPs) were recommended.

9:15 ANALYSIS OF A 72-HOUR PUMPING TEST OF AN UNCONFINED BURIED VALLEY AQUIFER: NEWARK WELL FIELD, LICKING COUNTY, OHIO. P.N. Spahr, M.P. Hallfrisch, R.J. Petty, M.P. Angle, W. Jones, K.M. Storts, D. Davis, ODNR, Division of Water, 1939 Fountain Sq. Dr., Columbus, OH 43224.

A 72-hour pumping test was conducted by the ODNR, Div. of Water, Ground Water Resource Section, at the Newark Well Field to assess the hydraulic properties of an unconfined buried valley aquifer. The constant discharge rate of 1800 G.P.M. was determined by a preliminary step test. Nested piezometers were installed at various spacings from the pumping well. Shallow well points and stream bed permeameters were used in the North Fork of the Licking River to determine the interaction between the river and aquifer. Graphical analyses were performed upon the draw down data to evaluate the vertical and horizontal conductivities of the aquifer system. The analysis, projections and recommendations were used as part of a Non-Point Source study of the Licking River buried valley aquifer system.

9:30 HYDROGEOLOGY OF THE RIVER STYX BASIN, NORTHEASTERN OHIO. Jeffrey S. Rizzo and John P. Szabo, Geology Dept., University of Akron, Akron, OH 44325-4101.

The River Styx basin in Medina and Wayne counties, Ohio, overlies a buried valley eroded into rocks of the Allegheny Plateau. The river flows southward from the St. Johns Moraine and is presently eroding Late Wisconsinan outwash and lacustrine deposits. Bedrock aquifers are sandstones of the Pottsville Group and members of the Cuyahoga Formation. The Mann-Whitney test differentiated among statistically juxtaposed aquifers, and showed that the hydrologic characteristics of the outwash were similar to those of the Armstrong Sandstone/Rittman Conglomerate aquifer of the Cuyahoga Formation. Hydraulic conductivities of the aquifers range from  $10^{-1}$  to  $10^{-5}$  cm/sec; transmissivities vary from 1 to 2800 m<sup>2</sup>/day. There is a complex exchange of water among aquifers. Ground water is discharged into streams at the contact of the Sharon Sandstone/Conglomerate and the Wooster Shale, and streams recharge the Armstrong Sandstone and the Rittman Conglomerate along sideslopes of the valley. Buried portions of the Rittman Conglomerate and sandier beds of the Meadville Shale facilitate the transfer of ground water to the outwash which eventually discharges into River Styx. Although water may be transferred along bedding and joints of bedrock, more water is transferred through near surface discharge and recharge.

9:45 RESISTIVITY INVESTIGATION OF THE FRESH WATER LENS ON NORTHEAST ANDROS ISLAND, BAHAMAS. Richard E. Cowles, Paul J. Wolfe and C. Carney, Wright State University, Dept. of Geological Sciences, 260 Brehm Lab, Dayton, OH 45435.

An electrical resistivity sounding survey of a portion of northeast Andros Island near Charley's Blue Hole was conducted to determine the local extent of the fresh water lens. The survey utilized the Schlumberger electrode configuration with a Johnson-Keck model IC69 each resistivity instrument. Twenty-two field stations were established along a 2.1 km transect on Charley's Road. The field data were analyzed using the geophysical program RESIX. Conductivity readings were taken for control in a bore hole located at the eastern end of the transect and at Charley's Blue Hole, located 1.5 km west of the borehole. Three-layer and four-layer models were produced to fit the field data. The results indicate a large fresh water Ghyben-Herzberg lens ranging in thickness within the study area from 9 to 14 meters. The modeling of three-layer

and four-layer cases produce similar results for the fresh water portion of the lens. However, the four layer model indicates a substantial mixing zone below the fresh water lens that ranges in thickness from 7 to 15 meters. Variations in the thickness of the lens and the mixing zone are the result of porosity changes within oolitic and bioclastic Pleistocene limestones.

10:00 BREAK

10:15 STATISTICAL INTERPRETATION OF GROUNDWATER CONTAMINATION OF A SUPERFUND SITE, UNIONTOWN, OHIO. Al J. Muller, and Jim L. Jackson, Geology Dept., The University of Akron, Akron, OH 44325-4101.

Statistical analyses were applied to groups of well water samples inside and outside the potentially contaminated area for glacial and bedrock aquifers. Results of analyses suggested that: (1) the groundwater chemistries of the bedrock and glacial aquifers are different, (2) the groundwater in the glacial aquifer is contaminated by  $\text{Mn}^{2+}$ ,  $\text{Na}^+$ , total Ni, total Pb, total Zn, and possibly  $\text{Cl}^-$  by waste buried at the IEL, (3) the groundwater in the bedrock aquifer appears to be uncontaminated except possibly by  $\text{Cl}^-$  by waste buried at the IEL, (4) groundwater in the bedrock and glacial aquifer in the vicinity of the IEL is under radial flow in agreement with work done by the USEPA (Bair and Norris, 1989), and (5) ground water chemistry remains fairly constant over time except for that in the shallow monitoring wells, and variation in iron concentrations suggesting the plume of contamination is stable. It is recommended that additional study be done so that any environmental remediation done at the site is as efficient and cost-effective as possible.

10:30 COMPARISON OF SATURATED HYDRAULIC CONDUCTIVITY, BY THE FALLING-HEAD METHOD, ON FOUR AGRICULTURAL SOILS. T.R. Wiley, B.D. Snyder, Z. Jiang, J.R.K. Nutor and L.C. Brown, Agricultural Engineering Dept., The Ohio State University, Columbus, OH 43210-1057.

A study of agrichemical transport and fate in soil-water systems is being conducted using laboratory soil columns. In-tact soil columns were collected in four agricultural soils in Ohio and Indiana; Blount silt loam; Brookston silty clay; Rossburg sandy loam; and Clermont Silt loam. Column diameter is 30 cm; soil core length ranged between 76 and 102 cm, depending on site conditions. Before conducting agrichemical transport tests, each soil-column system was analyzed to determine its physical properties. These data were used to help determine replicate soil column systems for agrichemical transport tests. This paper describes test results for saturated hydraulic conductivity,  $K_{sat}$ , and drainage parameters of 60 soil-column systems over four soils. The nine Brookston columns contained artificial macropores.  $K_{sat}$  was determined using a modified falling-head conductivity test. The mean and standard deviation in  $K_{sat}$  (cm/min), by soil, was: Blount -  $0.277 \pm 0.303$  ( $n=14$ ); Brookston (with macropores)  $6.10 \pm 1.07$  ( $n=9$ ); Rossburg -  $2.62 \pm 1.51$  ( $n=17$ ); and Clermont -  $0.316 \pm 0.698$  ( $n=20$ ).  $K_{sat}$  also was determined for the 14 Blount columns after a nine-month agrichemical transport test. The mean and standard deviation in  $K_{sat}$  was  $0.233 \pm 0.286$  ( $n=14$ ), which compared well to pre-test values. The paper describes the test procedure, data analysis, gravity drainage rate data, and methodology used to determine suitable soil columns for further testing.

10:45 OHIO'S LAKE PLAINS, THEIR PLEISTOCENE ORIGIN, POST DEPOSITIONAL HISTORY AND GEOTECHNICAL LIMITATIONS. Julie P. Weatherington-Rice, Douglas R. Hunter & Ronald T. Trivisonno, Bennett & Williams, 2900 E. Dublin-Granville Rd. Ste 500, Columbus, OH 43231.

In the past, Ohio's university Geology Depts. have not studied the Lake Plains subsurface, specifically northern historic drainage patterns as they relate to depositional processes, post depositional weathering and geotechnical limitations. The lack of outcrops and interdisciplinary interaction with Soil Scientists have left a void. Those of us who have studied the deposits seldom publish so there is almost no Ohio literature. Canada's Geologists, however, have published about Canadian and related US deposits. Many of the deposits are glaciolacustrine subaqueously deposited "water laid tills"/diamicts or pro glacial "varved" clays, not "typical tills". According to Ohio Soil Scientists, Ohio deposits are high in clay content and shrink - swell potential; crack to 30"; and remain open or reopen yearly. Because primary porosity is low, water and/or contaminants move through open secondary fracturing, more like rock than unconsolidated materials. Current geotechnical testing and monitoring is inadequate, often missing flow paths. These physical properties need to be rethought, new testing/monitoring systems developed and studies published.

## EARTH & SPACE SCIENCES

1:30 P.M., Saturday, May 1, 1993

Cushwa Hall 1105

Scott Brockman, Presiding

1:30 GRAVITATIONAL CAPTURE OF A LUNAR-LIKE PLANETOID BY AN EARTH-LIKE PLANET: GEOMETRY OF STABLE CAPTURE ORIENTATIONS. Robert J. Makuik, Geology Dept., and Ronald R. Winters, Physics Dept., Denison University, Granville, OH 43023.

For the past few years we have been doing co-planar, three body numerical calculations to assess the physical mechanisms of gravitational capture of planetoids by planets. Gravitational capture can be defined as the transfer of a planetoid from a heliocentric orbit to a planetocentric orbit. The purpose of this paper is to demonstrate that the geometric orientation of a close encounter relative to planets orbital path is a critical condition for stable capture. In general, we find that stable prograde capture can only occur when the major axis of the initial post encounter orbit is nearly perpendicular ( $+ \text{ or } -3^\circ$ ) to the tangent of the planet's orbit. A stable retrograde orbit, however, can be attained only when the orientation of the major axis of the initial post-encounter orbit is nearly parallel ( $+ \text{ or } -3^\circ$ ) to the tangent to the planet's orbit. We have done a set of calculations for the case of a circular planet orbit and a planetoid orbit with 0.0075 eccentricity. In earth anomaly terms the stable prograde capture orientations extend from  $210^\circ$  to  $300^\circ$  and from  $60^\circ$  to  $120^\circ$ . Stable retrograde capture orientations extend from  $235^\circ$  to  $245^\circ$  and from  $175^\circ$  to  $185^\circ$ . Earth anomaly refers to the initial starting position of the planet. From a series of these types of calculations, we should be able to quantify the probability of gravitational capture.

1:45 THE NEW ALEXANDRIA TO ASHLAND, KENTUCKY, HIGHWAY: AN EXTRAORDINARY GEOLOGIC "CLASSROOM." Gregory A. Schumacher, Paul E. Potter, and Martin C. Noger, ODNR, Division of Geological Survey, 4383 Fountain Sq. Dr., Columbus, OH 43224.

The diverse and spectacular geology exposed by the construction of the Alexandria to Ashland (AA) Highway provides Ohio's educators with an easily accessible "classroom" for geologic instruction. The AA Highway, which connects the greater Cincinnati area to the Ashland, Kentucky area, traverses the deeply dissected topography of northeastern Kentucky adjacent to the Ohio River. The route of the AA Highway provides a scenic cross-strike transect of the eastern side of the Cincinnati Arch and the western side of the Appalachian Basin. Nearly 100 road cuts expose Middle Ordovician through Lower Silurian interbedded siliciclastics and carbonates, Middle Silurian shales and dolomites, the Devonian shale sequence, Lower to Middle Mississippian clastics and carbonates, Middle Pennsylvanian detritic sediments, and three major unconformities. This stratigraphic sequence is ideal to study the lithofacies and sedimentary structures associated with shallow-marine, foreland-basin, delta-slope, and delta-platform depositional environments. Trace fossils, microfossils, and macrofossils occur in most lithofacies and provide clues to the age, oxygen content, and sedimentation rates of these rocks. Evidence of soft-sediment deformation and postdepositional folding and faulting at several road cuts provides a wealth of interesting structural features to study.

2:00 DIMENSION STONE RAILROAD ARCHITECTURE OF OHIO, MICHIGAN, AND INDIANA. Mark J. Camp, Dept. of Geology, University of Toledo, Toledo, OH 43606.

Railroad companies laying track across the Midwest in the mid to late 1800s made ready use of native materials in the construction of bridges and buildings. Wood was plentiful and often the choice, but depending on the availability of suitable dimension stone and the likes of management, stone was also used. The oldest strata used in the region was the PrePaleozoic Jacobsville Sandstone of the Portage Lake, MI area. Depots at Houghton and Kalamazoo, MI were constructed of this typical brownstone. The most prevalent strata used, however, were Mississippian limestones and sandstones from Indiana and Ohio. The Salem Limestone was the most popular building material and found use in depots at Bedford, Bloomington, Gary, Lafayette, Mitchell, West Baden and French Lick, IN and at Akron and Springfield, OH. Brick depots at Greensburg and Terre Haute, IN and Columbus, OH featured Salem Limestone trims, finials, and elaborate carvings. The Berea Sandstone was employed at depots in Berea, Galion, Painesville, Sandusky, and Troy, OH and at Bay City, Hudson and Niles, MI. The Berea Sandstone was also the favored material for bridge and culvert construction on the LS & MS Railroad through northern Ohio-Indiana and southern Michigan. Glacial cobbles were utilized in depots erected at Ann Arbor, Grass Lake, Lawton, Standish, and Wyandotte, MI. At Cement City, MI, where marl was dredged to make Portland Cement, the depot was of concrete composition. Interior stonework of the more prominent depots was often marble or granite shipped in from New England.

2:30 LEGACIES AND MONUMENTS OF NOTABLE EARLY GEOLOGISTS OF NORTHEASTERN OHIO. Joseph T. Hannibal, The Cleveland Museum of Natural History, 1 Wade Oval Dr., University Circle, Cleveland, OH 44106-1767.

Notable nineteenth and early twentieth century geologists of northeastern Ohio include Col. Charles Whittlesey (1808-1886); Samuel St. John (1813-1876); John Strong Newberry (1822-1892); Matthew C. Read (1823-1902); Rev. Herman Herzer (1833-1912); Edward W. Claypole (1835-1901); and George Frederick Wright (1838-1921). Whittlesey is noted for work on glacial geology and shore erosion; St. John for his early (1851) geology text; Newberry for paleontological research; Read for basic geological work for the Ohio Survey; Herzer for his collections of fossils; Claypole for research and teaching; and Wright for public presentations (documented by his clippings service) and work on glacial geology. Herzer is honored by a plaque at Baldwin-

Wallace College, but the Herzer Museum at that college is long gone. Homes of Read (Hudson) and Wright (Oberlin) are still standing, although the latter is slated for demolition by Oberlin College. A glacial lake and beach ridge, a genus of fossil plant, and an archaeological culture unit (the Whittlesey Tradition) are named in Whittlesey's honor. Fossils have also been named in honor of Newberry and Herder. The stone used for the headstones of Whittlesey (Lake View Cemetery, Cleveland) and Wright (Westwood Cemetery, Oberlin) are jasper metaconglomerates derived from the Lorrain Formation of the Lake Huron region, reflecting their interest in this exotic rock type. Newberry is buried in Lakeview Cemetery near outcrops of rock units which he named; his work includes a description of a fossil fish from these outcrops.

2:30 THE LEGACY OF JOHN STRONG NEWBERRY (1822-1892): A REVIEW IN COMMEMORATION OF 100 YEARS SINCE HIS DEATH. Joseph T. Hannibal, The Cleveland Museum of Natural History, 1 Wade Oval Dr., University Circle, Cleveland, OH 44106-1767.

John Strong Newberry, Ohio's most prominent early geologist, is best known today for his work in vertebrate paleontology and paleobotany, and as head of the second Ohio Geological Survey. Newberry also participated in several western expeditions, making a number of important early observations and discoveries. He was the first geologist to describe the Grand Canyon and was the first to discover the remains of a sauropod dinosaur in North America. Newberry studied under Samuel St. John (1813-1876) at Western Reserve College in Hudson, Ohio, and named his firstborn son Arthur St. John. Newberry's work continues to be cited at a respectable rate today. Fossil invertebrates, vertebrates, and plants, a large volcano in Oregon, a prominence in the Grand Canyon, and a preglacial river in Ohio, have all been named in his honor. Three of Newberry's sons founded what was to become the Medusa Portland Cement Company. Newberry papers and correspondence can be found in a number of institutions in several states. These include an unpublished journal (1849-1850) by Sarah Gaylord Newberry, John Strong's spouse, housed in the Western Reserve Historical Society. Newberry's collections and type and figured specimens are housed in several institutions. Many of the Ohio specimens are deposited in the American Museum of Natural History.

2:45 DISTRIBUTION AND LITHOLOGY OF ILLINOIAN TILLS IN LICKING COUNTY, OHIO. John P. Szabo, Stanley M. Totten and Michael P. Angle, Geology Dept., University of Akron, Akron OH 44325.

Many of the Illinoian tills which crop out in Morrow and Knox counties can be traced into Licking County. Low carbonate till (BI and correlative of the Millbrook Till at its type section) crops out throughout the county. High carbonate till (BII) correlates with the Gahanna Till of the Rocky Fork Drift. An older till of intermediate carbonate content (BIV) crops out east of the Gahanna Till boundary but is not as extensive as the Millbrook Till. Multiple beds representing different facies of Gahanna Till crop out along streams near Alexandria and suggest oscillations of an Illinoian front. Late Wisconsinan Navarre Till overlies Illinoian till in many sections. Clay contents of Illinoian tills decrease and sand contents increase with increasing age. Millbrook Till contains about 6% dolomite and a small amount of calcite. Gahanna Till has a calcite/dolomite ratio equal to 0.3, averages 16% total carbonate, and has as much as 23% total carbonate in some samples. The oldest Illinoian till averages 11% total carbonate, and calcite/dolomite equals 0.2. In the clay fractions, illite/kaolinite and chlorite averages 1.2 for all tills. The 1-2 mm fractions of the tills are dominated by local elastic rocks and contain extra local carbonates eroded from outcrops in Delaware and Franklin counties.

### 3:00 POSTER BREAK

3:30 A MULTI-REGRESSION MODEL USING FRAMEWORK GRAIN CONTACT RELATIONSHIPS TO PREDICT POROSITY IN ESTUARINE, FLUVIAL SANDSTONES. Kenneth A. LaSota and Renato Clavijo, Robert Morris College, Dept. of Natural Sciences, Pittsburgh, PA 15219-3099.

The distribution of sand-sized material (sorting) is commonly used in multi-regression models, combined with other variables (i.e. total cement and percent matrix, among others) to predict porosity in sandstones. Textural variables concerning the contact relationships among framework grains, as proposed by Jane M. Taylor in 1950, have not been assessed to determine their potential for predicting porosity. In this study, the number of grain contacts per framework quartz grain (mean 1.31 per grain), the percentage of framework grains with no contacts or floating grains (mean 45.56%) and the percentage of framework grain contacts that are tangential in nature (mean 67.78%), concavo-convex (13.71%), straight (7.70%) or sutured (10.81%) are quantified for 31 Upper Devonian (Venango Group) estuarine, fluvial, fine grained (mean 0.129mm) feldspathic graywacke (18.97% matrix) sandstones from Johnstown, Pennsylvania. The samples average 10.25 porosity. It was found that coupled with sorting (the standard deviation of the apparent longest dimension of the framework grains, mean 0.05mm), tangential contacts are the best predictor of porosity. The model (porosity =  $5.582 + 21.137(\text{sorting}) + 0.002(\% \text{ tangential contacts})$ ) is significant ( $p < 0.05$ ) and predicts 87.77% of the porosity. The model suggests contact relationships among framework grains can be added to the list of petrographic variables shown to be predictors of porosity in sandstones.



3:45 CLAY MINERALOGY OF OHIO MUDROCKS. Jeffrey C. Dick and Abdul Shakoar, Dept. of Geology, Youngstown State University, Youngstown, OH 44555.

As a part of an investigation of the geological and engineering characteristics of North American mudrocks, quantitative clay mineral analyses of twenty one mudrocks from Ohio were performed. The representative mudrock sample population included 10 shales, 10 mudstones, and 1 claystone ranging in age from upper Ordovician to upper Pennsylvanian. The clay mineral analyses were performed using X-ray diffraction and hydrometer particle size analysis techniques. The clay mineral content of the mudrocks ranged between 16 and 38 percent. Clay minerals were present as assemblages of illite, mixed-layer illite-smectite, kaolinite, and chlorite in virtually all the mudrocks. Illite was the dominant clay mineral in most of the mudrocks with an average weight percent of 13.5 percent followed by kaolinite (6.3 %), mixed-layer illites-mectite (4.8%), and chlorite (1.8 %). The relative proportions of illite and mixed-layer illite-smectite minerals exhibit a correlation with the geologic age of the mud rocks. The quantity of illite tends to increase with geologic age while the quantity of mixed-layer illite-smectite tends to decrease with geologic age. These trends are consistent with other research findings suggesting that mixed-layer clays transform into illite with increasing age and depth of burial.

4:00 EXPERIMENTS TO TEST THIOSULFATE AS A COMPLEXING AGENT FOR GOLD TRANSPORT. Burvee M. Franz and Christopher Kenah, Dept. of Geology and Geography, Denison University, Granville, OH 43023.

Thiosulfate is one of the complexing agents that may be important in transporting gold in aqueous solutions in the surface environment. Experiments on the geochemical system  $\text{Au-Na}_2\text{S}_2\text{O}_3\text{-H}_2\text{O}$  were performed to test thiosulfate's role in gold dissolution. The apparatus consisted of a round bottomed flask with stirring rod and a reflux condenser to prevent evaporation. The system was investigated at two temperatures, 20-25°C and 45-55°C, and at two concentrations of the thiosulfate ion, .05 molar and .5 molar. The thiosulfate ion promotes dissolution of gold. 14K gold wire was used in these experiments. We found erratic rates of dissolution. The maximum rate of gold dissolution was .09 wt. %/week, except in one case where a black precipitate formed which we believe is a sulfide of Cu, Zn, or Ag from the 14K alloy. Because the dissolution rate was not as high as expected, the importance of the oxidation state was tested by experiments in which the thiosulfate solution was saturated with  $\text{N}_2$  and  $\text{O}_2$ . We found that the presence of oxygen in the solution is essential for gold complexes to form. Although the thiosulfate concentration in these lab experiments exceed natural concentrations, the data support the importance of thiosulfate complexes in the transport of gold in surface aqueous solutions. This has important implications for the processes of the growth of gold nuggets by chemical accretion in the surface environment.

4:15 COMPUTERIZATION OF ABANDONED DEEP COAL MINE DATA. Ann G. Harris and Kenneth J. Izzo, Dept. of Geology, Youngstown State University, 410 Wick Ave., Youngstown, OH 44555-0001.

Information on abandoned deep coal and clay mines is found in many sources. Placing all this information in a hard copy file for each mine for a single county fills two or three file drawers and Ohio has 35 counties with mines. This method of storage is also not conducive to the correlation of all the information common to most mines. However, storing all of this information, including mine maps, on computer disks, solves all of these problems. Therefore, a database was created and modified as new needs or problems arose. Each mine has a data sheet with information that is common to most mines. The remaining information, specific for that mine only, was entered under comments by the year. A filtering system to create data sheets for the new mines entered was created using key words e.g.: near, by, at, or on, for location determination. After much trial and error a method has been developed using several programs to scan even the largest of mine maps into the database. It is possible to enter topographic maps into the program. These maps can be called up at the same time as the rest of the information. The entry of all of this data is very time consuming; presently mine data of five counties has been entered. These are Mahoning, Trumbull, Columbiana, Stark and Jefferson Counties.

4:30 RADON RESEARCH PROGRESS REPORT: HEALTH RISK IN NORTHEASTERN OHIO? C. R. Singler, I. Khawaja, and E. Abram, Dept. of Geology, Youngstown State University, Youngstown, OH 44555.

The USEPA has issued guidelines regarding the level of indoor radon that homeowners might encounter and the relative health risk posed by indoor radon. The Y.S.U. Radon Service has been testing for radon since 1988, and reports here its latest findings for indoor radon in northeastern Ohio. The studies of 1988-1990 indicated an increasing amount of indoor radon, and hence an increasing health risk from indoor radon, in a north-to-south traverse of approximately 100 kilometers (100 miles) along the eastern side of the state. The studies of 1992-1993 enlarge the study area to 20 counties in northeastern Ohio, and preliminary findings are reported.

## BEHAVIORAL PHYSIOLOGY, ENTOMOLOGY, & BOTANY

1:30 P.M., Saturday, May 1, 1993

Cushwa Hall 2024

Alan Cady and Tod F. Stuessy, Presiding

1:30 REGULATION OF OVARIAN ACTIVITY BY SOCIAL AND PHOTOPERIODIC SIGNALS IN SIBERIAN HAMSTERS. Neeraj Badjatia and Teresa H. Horton, Dept. of Biological Sciences, Kent State University, Kent, OH 44242.

The inhibitory effects of female-female interactions and short photoperiod on ovarian function are not well characterized in Siberian hamsters. To document the inhibitory effects of female-female interactions in this species, vaginal lavages were taken from group (GRP) and individually (IND) housed hamsters. Vaginal cytology is correlated with circulating steroid levels, therefore vaginal cytology can be used as an index of ovarian function. Vaginal cytology characteristic of enhanced ovarian activity occurred more frequently in IND than in GRP females (Exp 1: 92% IND vs 40% GRP ( $\chi^2 = 9.13$ ,  $p < 0.05$ ). Exp 2: 94% of IND vs 57% of GRP ( $\chi^2 = 6.60$ ,  $p < 0.05$ ). The effects of photoperiod and female-female interactions were compared. IND and GRP females were placed in LD (16 h light/day) or SD (12 h light/day), vaginal lavages were taken, and females were sacrificed after 3 wks of treatment. Ovarian activity, as assessed by vaginal cytology, was suppressed in GRP females in both LD and SD ( $\chi^2 = 7.82$ ,  $0.10 > p > 0.05$ ). Uterine weight, an indicator of estrogen secretion, was significantly suppressed by short photoperiod and group housing (ANOVA: Photo.  $p < 0.003$ , Housing  $p < 0.01$ ),  $df = 1, 27$  for both factors). Ovarian histology and serum gonadotropin levels will be compared to determine if photoperiod and social factors inhibit ovarian function by a common endocrine mechanism in Siberian hamsters.

1:45 DEVELOPMENT OF SIBERIAN HAMSTERS FROM SHORT-DAY RESPONSIVE AND NON-RESPONSIVE LINEAGES IN LONG AND SHORT PHOTOPERIODS. Kristina M. Stanfield and Teresa H. Horton, Dept. of Biological Sciences, Kent State University, Kent, OH 44242.

Short photoperiod inhibits reproductive development and induces gonadal regression in juvenile and adult Siberian hamsters, *Phodopus sungorus* (short-day responsive, SD+). Some laboratory populations of *P. sungorus* contain individuals that are not responsive to short days as adults (short-day nonresponsive, SDNR). Age related decreases in sensitivity to short days have been reported between juvenile and adult meadow voles and in extremely old Siberian hamsters. The sensitivity of juveniles from SDNR lines of *P. sungorus* have not yet been studied. Male and female young of SDNR and SD+ hamsters were placed in long (16L:8D) and short (12L:12D) photoperiods and sacrificed at 45 days of age. Body weight, testicular, epididymal and uterine weights were determined. The effects of phenotype and photoperiod were compared using two-way ANOVA. The inhibitory effects of short photoperiod were observed in both strains of hamsters with regard to all parameters (ANOVA:  $p < .05$ , for all parameters). However, there was no significant effect of phenotype nor a significant interaction between photoperiod and phenotype. These results suggest that juveniles from the SDNR lines are able to respond to the inhibitory effects of short photoperiod. This may indicate that SDNR individuals lose the ability to respond to short days after puberty as seen in voles.

2:00 RESPONSES OF COCKROACHES (*BLATTELLA GERMANICA*: INSECTA) TO ORAL ADMINISTRATION OF THE POWERFUL MAMMALIAN SOMNOGEN, MURAMYL DIPEPTIDE. Alan B. Cady, Dept. of Zoology, Miami University-Middletown, Middletown, OH 45042.

Many compounds have been shown to influence the onset, maintenance, and cessation of mammalian sleep. The most important are the cytokines produced by immune cells and products emanating from viral or bacterial infections. Of these, muramyl dipeptide (MDP;  $\text{N-acetyl-muramyl-L-alanyl-Disoglutamine}$ ), a synthetic analog of bacterial cell wall peptidoglycan, is the most powerful mammalian somnogen. One picomole of MDP will increase the duration of rabbit slow wave sleep for six hours. Because of the relationship between mammalian immune systems and sleep, the identification of an insect immune system provided an opportunity to investigate the roots of mammalian sleep. Cockroaches (*Blattella germanica*) were placed into an apparatus which recorded their movements. The insects were water-deprived for 24 hrs., given 10  $\mu\text{l}$  of distilled water the next day, then they received 10 nanomoles of MDP in 10  $\mu\text{l}$  of distilled water. The following day they were again given 10  $\mu\text{l}$  of distilled water. It was found that MDP did not markedly decrease the total number of movements for pooled data, however, the somnogen did change activity patterns. The cockroaches maintained their periodicities, but times of reduced activity had significantly fewer movements after MDP treatment. Thus, a mammalian somnogen influenced the rest-activity cycles of an arthropod. This highlights the importance of the immune system to sleep regulation and points directions for further study into the evolution of sleep.

2:15 AN INVESTIGATION OF NON-PEPTIDES AS MOLT INHIBITING HORMONES IN THE CRAYFISH *ORCONECTES IMMUNUS*. Chris J. Webb and Thomas C. Jegla, Kenyon College, Gambier, OH 43022.

Crustacean growth is coupled with the periodic shedding of the exoskeleton. This periodic molt is hormonally controlled by increasing levels of ecdysteroids in the hemolymph which are produced by a pair of endocrine glands (Y-organs) in the cephalothorax of the crustacean. The Y-organs' production of ecdysteroids is negatively controlled by the X-organs in the eyestalks. The X-organs secrete a molt-inhibiting hormone (MIH) which inhibits ecdysteroid production at the Y-organ. Several peptides isolated from eyestalk extract have been proposed as possible MIH: Mattson and Spaziani, 1985, Webster and Keller, 1986, and Chang et al., 1990. In 1987 Naya et al. isolated two purines, 3-hydroxy-1-kynurenine and xanthurenic acid, which were shown to have molt inhibiting activity. We tested these compounds for MIH activity in *O. immunus* and found that neither compound, at levels which are normally found in crustaceans, inhibits Y-organ production of ecdysone. Only at levels approximately 200x stronger than those found in Blue Crab hemolymph by Naya et al. for the precursor 3-hydroxy-1-kynurenine was inhibition observed. It is possible that at this high concentration the compound is toxic to the tissues. Using the homogenate system developed by Naya et al. future research will be able to directly regulate intercellular  $Ca^{++}$  and determine its effect on ecdysteroidogenesis.

2:30 DIGESTIVE SYSTEM OF THE TERRESTRIAL ISOPOD CRUSTACEAN, *PORCELLIO SCABER*: CARDIAC AND PYLORIC STOMACHS. Roger L. Lane, Kent State University-Ashtabula Campus, Ashtabula, OH 44004.

The lumen of the cardiac stomach is lined by a generally thin cuboidal to short columnar epithelial mucosa. The mucosa of the pyloric stomach is thicker. The intrinsic muscularis of circular fibers is thin and forms the rest of the stomach wall. Heavier extrinsic muscles insert on the wall of the stomachs, particularly on that of the pyloric stomach. Dorso-median, dorso-lateral, and ventro-lateral folds of the mucosa subdivide the lumen of the cardiac stomach. A large fold, generally referred to as a "gland filter," is found in the ventral floor of the pyloric stomach. The right and left lumens thus formed by this ventral fold are lined on both sides by setae. The anterior area of the cardiac stomach is quite simple. In the dorso-lateral area of the more posterior reaches of the cardiac stomach opposing plates of setae are found, forming a masticatory apparatus. Setae with Y-shaped distal ends and a larger filtering apparatus are found at the entrance to and within the pyloric stomach. Smaller particles are diverted to the intestine; larger particles, to the intestine. Mandibular mastication appears to be more important in terrestrial isopods than other higher Crustacea.

2:45 BREAK

## Tod F. Stuessy, Presiding

3:00 EXAMINING PREFERRED HOSTS OF DEER TICKS (*Ixodes dammini*) IN NORTHEAST OHIO AND NORTHWEST PENNSYLVANIA. Carey L. Etling and Thomas B. Cole, Jr., Biology Dept., Hiram College, Hiram, OH 44234.

Mice of the genus *Peromyscus* are the preferred hosts for the immature stages of the deer tick, *Ixodes dammini*, and white-tailed deer, *Odocoileus virginianus*, are the prime hosts for the adult ticks in Northeast and Midwest United States deer ticks can carry the spirochete that causes Lyme disease. Mice were trapped at nine sites approximately ten miles apart along a transect line extending from the Hiram College JH Barrow Field Station, Portage County, Ohio, to Presque Isle State Park, Erie County, Pennsylvania. No adult ticks were found on any of the 68 rodents captured at the nine trapping sites. Rodents captured at Site #9, Presque Isle State Park, did not have any adult ticks, yet adult ticks were found while flagging in the same area. No ticks were found on any of the 59 captured animals at trapping Sites No. 1 through No. 8. White-tailed deer from Ashtabula, Trumbull and Geauga Counties were examined at a deer check station in Andover, Ohio. No ticks were found on any of the 168 white-tailed deer checked at the station. Fourteen deer from Erie and Crawford counties, Pennsylvania were also examined for ticks. All the white-tailed deer examined from Erie County, Presque Isle State Park, had ticks. This study took place during the Fall and early Winter months. Since the deer tick has a two year life cycle this study will continue during the Spring and Summer months.

3:15 TWO YEAR SURVEY OF MOTHS IN SCIOTO COUNTY. Stephanie Burke, Robert Deal, and David Todt, Natural Science Dept., Shawnee State University, Portsmouth, OH 45662.

A two year survey and collection of moths in rural Scioto County, Ohio was conducted to fulfill the Senior Project requirement for Shawnee State University. The 515 specimens collected will serve as the foundation for the moth portion of an entomological collection at SSU. Representatives of 12 families were collected during sampling done during every two hours, April-October, 1991 and 1992. Data on weather conditions and time of collection were noted. Interesting observations of emergence patterns, population peaks and duration of seasonal activity and impact of time and weather on moth activity were noted.

3:30 EFFECT OF RAIN FOLLOWING PROLONGED DROUGHT ON SAPROPHYTIC MOLD AIRSPORES. Francis E. Nussbaum, Kent State University-Tuscarawas Campus, New Philadelphia, OH 44663.

The early summer drought of 1988 subsided with the return of moderate precipitation in late July. The airspores disseminated by saprophytic molds during the drought stricken weeks of late June and early July are at variance with the saprophytic mold airspores collected in late July and early August. For the collection interval reported here, the standard airspore abundance index (SAI) at 80 cm above the campus lawns is 1600 cfu/100 cm<sup>2</sup>/hr on yeast malt extracts agar plates used to sample airspores by gravitational sedimentation. Eight collection sites were sampled biweekly on 24 June, 8 July, 22 July and 5 August with variation noted for microenvironment, time of day, and date of the collection as percent of SAI: time of day for all sites and dates—morning 0.68, midday 0.59, afternoon 0.43, evening 0.63; microenvironments for times and dates—lawn 0.99, pine grove 0.52, sycamore grove 0.29, arborvitae windbreak 1.06, parking lot 0.27, hay field 0.61, stream bank 0.49, soybean field 0.45; dates for all sites and times—24 June 0.25, 8 July 0.27, 22 July 1.48, 5 August 0.33. Vegetation phenology, diurnal spore liberation, and daily weather contribute to airspore variation, but the onset of rain following drought is prime.

3:45 THE SYSTEMATICS AND BIOGEOGRAPHY OF *ACICARPHA* (CALYCERACEAE). Melanie L. DeVore, The Museum of Biological Diversity and Dept. of Plant Biology, The Ohio State University, Columbus, OH 43210.

The genus *Acicarpha* is distinct from other genera within Calyceraceae by possessing indeterminate capitula, filamentous thickenings at the anther bases, and a basic chromosome number of  $x = 8$ . Recent field and herbarium studies of *Acicarpha* suggest that species within the genus can be segregated into two sections. One section, with tetramerous flowers, short calyx lobes, and freely dispersed achenes, consists of two species and is centered in southern Brazil. The second section is characterized by pentamerous flowers, elongate calyx lobes, and a fused achene-receptacle dispersal unit. Included within this section is the variable, widespread, species *A. tribuloides* (Brazil, Uruguay, Argentina, Paraguay, Bolivia, and Peru), *A. procumbens* (Argentina and Uruguay), and *A. spathulata* (southern Brazil). Cladistic analysis indicates that these three species are more derived than members of the tetramerous section of the genus. *Acicarpha* has a different biogeographic history from other genera within Calyceraceae which have evolved in the Andes.

4:00 PHYLOGENY OF BARNADESIOIDEAE AND EARLY EVOLUTION OF COMPOSITAE. Tod F. Stuessy and Tao Sang, Dept. of Plant Biology and Museum of Biological Diversity, The Ohio State University, Columbus, OH 43210.

Recent cpDNA studies on the Compositae have indicated the presence of a large 22-kb inversion that is diagnostic for most members of the family. The only exception known to date occurs among genera of the former subtribe Barnadesiinae of tribe Mutisieae, now regarded as a separate subfamily. This group consists of nine genera and approximately 80 species. Cladistic parsimony analysis was completed among 17 representative taxa of Barnadesioideae based on 19 characters of evolutionary import and using Calyceraceae as outgroup. The results suggest that *Schlechtendalia* is most primitive followed by *Dasyphyllum*, both suspected of being insect-pollinated. The hummingbird-pollinated genera *Chuquiraga* and *Barnadesia* are more derived morphologically. These results plus present distributional data suggest that the family may have had a southern South American origin in lower elevations on the eastern side of the Andes rather than in the high northern Andes as has been suggested previously.

4:15 EMANUEL D. RUDOLPH'S UNPUBLISHED RESEARCH ON THE POPULARIZATION OF BOTANY. Ronald L. Stuckey, Herbarium, Museum of Biological Diversity, The Ohio State University, 1315 Kinnear Rd., Columbus, OH 43212.

The late Emanuel D. Rudolph had a life-long interest in the history of science, particularly in biology and botany. His research focus was directed toward the development and understanding of the popularization of biology and botany during the 19th and 20th centuries. He examined the role of women and non-professional individuals, studied children's books and popular adult literature, and reviewed contributions of botanical artists and practicing physicians. His planned *History of the Missouri Botanical Garden* was intended, in part, to relate its development to the historical trends occurring in frontier cities, the training of professional botanists and gardeners, and the use of philanthropy in American science. Prof. Rudolph contended that historians of science overlook the popularization of botany because its original reference sources are not part of the main course of scientific literature. Analyses must come from popular writings, botanical text books, and children's botanical and natural history books, including chapbooks. His own 53,000+ book collection was to serve as a basis for this unique research effort. At least eight manuscripts are in various stages of completeness.

## RESOURCE MANAGEMENT & ENVIRONMENTAL PROTECTION

9:00 A.M., Saturday, May 1, 1993

Cushwa Hall 2025

Susan Thomas, Presiding

9:00 PROTECTION OF KARST RESOURCES - ARE WE TOO LATE? Horton H. Hobbs III, Dept. of Biology, Wittenberg University, PO Box 720, Springfield, OH 45501-0720.

Caves, springs, sinkholes, and numerous other solution features are characteristic of areas underlain by carbonate bedrock. Even though state "Cave Protection Laws" and a recently implemented Federal Cave Resources Protection Act exist, most karst features, including their unique speleothems and communities, are without adequate protection. With thin overburden, effects of surface perturbations are quick to impact Karstic features (e.g., salt deicing of roads, purposeful or accidental spills of hazardous materials into sinkholes). Pesticides bioaccumulated in insectivorous bats utilizing caves can cause extirpation not only of the bats but also of the terrestrial and aquatic subterranean organisms dependent on the bat guano energy input. Use of caves by humans for recreation, exploration, or scientific study often alters these environments dramatically. Resource inventories (including environmental and community information as well as potential cave wilderness resources and values), development of management plans, and their implementation are essential steps required to conserve and protect these unique resources.

9:15 AMPHIBIANS AND REPTILES OF SOME HAMILTON COUNTY PARKS. David Rubin and Wanjiku Kabiru, Dept. of Biology, Central State University, Wilberforce, OH 45384.

From 1990 to 1992, amphibian and reptile survey at Sharon Woods (737 acres) in northeastern Hamilton County and Winton Woods (2133 acres) in north central Hamilton County yielded 17 and 19 species respectively. Addition of two species by supplemental work at Miami-Whitewater Forest (2262 acres) in northwestern Hamilton County raised the number of species recorded there to 30. Low herpetological diversity at Sharon Woods and Winton Woods, both located in heavily populated areas, is probably a reflection of human disturbance. Records for Sharon Woods include the spring salamander, *Gyrinophilus porphyriticus*, which is at the limits of its range in Hamilton County. Records for Winton Woods include the cave salamander, *Eurycea lucifuga*, which is now known from five Hamilton County Parks. The cave salamander was found at eight sites in Miami-Whitewater Forest. While it is state-endangered because of its limited distribution in Ohio, it is common in western Hamilton County. The dusky salamander, *Desmognathus fuscus*, was not found at Winton Woods. The published record for the dusky from the vicinity of Winton Woods (Greenhills) is questionable and is based on a museum specimen (OUVC) that could not be located. The dusky appears to be restricted to the eastern part of the county. Record of the long-tailed salamander, *Eurycea longicauda*, from Miami-Whitewater Forest is the first for that species in western Hamilton County.

9:30 BARK-STRIPPING BY WHITE-TAILED DEER IN EASTERN OHIO. Jack Kovach and John H. Matthews, Geology Dept., Muskingum College, New Concord, OH 43762.

Previous workers have reported that bark-stripping by white-tailed deer (*Odocoileus virginianus*) has been observed in Virginia, West Virginia, Maryland and Illinois during the past 10 years or so. The reports indicate that bark-stripping in these areas occurs only in late winter and early spring and that slippery elm (*Ulmus rubra*) is the only species of tree being stripped. We provide here what, to our knowledge, is the first published record of the occurrence of bark-stripping by white-tailed deer in Ohio. The phenomenon was first observed in early February 1992 along the south edge of the golf course in Salt Fork State Park, Guernsey County. The most extensive occurrences of bark-stripping in the area, however, are in the southeast portion of the park. The only trees stripped are slippery elms (of all sizes), many or most of which will die (or have died) as a result of having been completely "girdled." The patterns of growth/regrowth of bark/scar tissue on damaged trees indicate that bark-stripping by white-tailed deer has been going on for at least 3 winter-spring seasons in this area — i.e., since at least the late winter of 1990. Possible causes and some implications of this curious (albeit, apparently, increasingly-widespread) behavior by white-tailed deer will be addressed.

9:45 PAPER MILL SLUDGE FOR TREE ESTABLISHMENT ON COAL MINE SOILS. David A. Kost, John P. Vimmerstedt, Marilyn M. Larson, and Walter D. Smith, School of Natural Resources, OARDC, Wooster, OH 44691.

In a split-split-split plot experiment we tested two depths (15 or 61 cm) of sludge as main plots, two methods (backhoed to 90 cm depth or not backhoed) to incorporate sludge and relieve soil compaction, three tree species (walnut, sycamore, ash), and three methods of seedling protection (no shelter, netting, or Tubex). Sparsely vegetated mine soils were regraded to a

rolling topography before sludge application. Significant interactions of sludge depth with sludge incorporation, tree species, and tree shelter affected first year survival. Survival was significantly lower on the 61 cm-not back hoed treatment (19%) than on the 61 cm-backhoed (79%), 15 cm-not backhoed (86%), or 15 cm-backhoed (90%) treatments. Black walnut had significantly lower survival on the 61 cm versus 15 cm sludge treatment (31% versus 80%) than sycamore (52% versus 90%) or white ash (64% versus 93%). Tree survival was significantly greater for the netting (90%) and Tubex (91%) shelters than for no shelter (83%) on the 15 cm sludge but not on the 61 cm sludge (48-50% for all shelter treatments). Total tree height did not differ significantly among incorporation treatments. All tree species differed significantly in height (80 cm for sycamore, 48 cm for ash, 36 cm for walnut). Height also varied significantly among all shelter treatments (77 cm for Tubex, 47 cm for netting, 40 cm for no shelter).

10:00 INDUSTRIAL SOLID WASTE IN AN REQ MODEL FOR NORTHEAST OHIO. Clyde D. Morris, Economics Dept., Youngstown State University, Youngstown, OH 44555.

Most primary pollutants reduced by abatement technologies, for example, sulfur dioxide, are fluid wastes that had been disposed of in the commons of the air and water. By First Law reasoning the reduction of these pollutants will result in an increase in the generation of secondary pollutants (waste products of pollution abatement processes). Since secondary pollutants tend to be solids (sludge, ash, etc.), clean air and water legislation will increase the solid waste disposal problem as fluid wastes are controlled. These solid wastes accumulate on private property, requiring a different use of the economic controls of taxes, subsidies, bribes, fees, and liability exposure. Same prospects and hypotheses: more stringent regulation of air and water pollution will lead to a greater use of landfills (including on-site storage), there will be a more intense regulation of landfills (even as capacity diminishes), leading to a more comprehensive form of environmental regulation (because solid wastes are disposed of on private property and are therefore more easily regulated). Methods used in the Residuals and Environmental Quality (REQM) model of Kneese and Bower for the Lower Delaware Valley are appropriate to the ecological-economic analysis of waste management in Northeast Ohio.

10:15 WATER POLLUTION CONTROL AT ALL COSTS: DETERMINING THE SOCIAL AND ECONOMIC IMPACTS OF WASTE WATER TREATMENT PROJECTS. Susan K. Thomas, Ohio Environmental Protection Agency, 1800 Watermark Drive, PO Box 1049, Columbus, OH 43266-0149.

Compliance with environmental protection laws can place a severe economic burden on small communities. Grant funds for wastewater treatment improvements are limited and are typically available to only the poorest communities, as established by median household income. Factors other than income, however, can contribute to substantial economic impacts when pollution control costs are incurred. Population characteristics dictate to a considerable extent the per household costs of waste water treatment and consequently the degree of economic impact. The intent of this research was to develop a set of indicator variables that will be useful to project planners in determining whether a proposed pollution control project will result in a significant adverse economic impact to the community. Ohio communities that had previously made waste water treatment improvements and had experienced varying degrees of economic impact were analyzed in order to identify the relevant variables and define an acceptable range for each. Population structure and trends are fundamental indicators of a small community's ability to afford centralized waste water collection and treatment in the long term.

10:30 TOWARD THE IMPROVEMENT OF COMMUNICATIONS IN SCIENCE AND TECHNOLOGY: REFLECTIONS OF AN ACADEMIC IN THE FIELD OF NATURAL RESOURCES POLICY. Robert L. Vertrees, School of Natural Resources, The Ohio State University, 2021 Coffey Rd., Columbus, OH 43210-1085.

The author has taken an active interest in improving communications among scientists and engineers since the late 1960s when, as a graduate student in a highly interdisciplinary program in Natural Resources Development, he studied Philosophy of Science and Social Science. In this paper, he reflects on, classifies, and places into the perspective of pertinent literature some of the experiences he has had in trying to communicate clearly with academic colleagues, professional contacts, students in courses, and student advisees in the growing and changing field of Environmental and Natural Resources Policy and Planning. He offers recommendations for improvements in the language used by scientists and engineers when discussing topics such as scientific method, relations between and among disciplines and fields, the sociology of knowledge, value judgments vis-a-vis professional judgments and expert opinion, approaches to planning, scientific and technical controversies, and information management (particularly geographic information management systems). He also recommends that interdisciplinary, multidisciplinary, and cross disciplinary research be conducted on topics such as the roles of scientific, technical, and ordinary language in information and technology transfer and in the complex processes through which the terminology of disciplines and fields evolves.

# ENVIRONMENTAL POLLUTION & ABATEMENT

1:30 P.M., Saturday, May 1, 1993

Cushwa Hall 2025

Yung-Tse Hung, Presiding

1:30 SITING A MUNICIPAL SOLID WASTE LANDFILL IN A LIMESTONE QUARRY. Theodore M. Dunchak, Rick J. Buffalini, and Deborah A. Lange, Browning-Ferris Industries of Ohio, Inc., PO Box 5240, Poland, OH 44514.

There are several technical and regulatory issues related to siting a municipal solid waste landfill in a limestone quarry. Among the issues are the following: (1) formation of a "sink" - the natural tendency for groundwater and surface water runoff to accumulate within a typical quarry; (2) migration through highwalls - the possible migration of leachate and/or methane gas laterally into the quarry highwalls; (3) solution activity - reaction of the groundwater with the carbonate minerals forming the limestone may comprise the stability of the surrounding rock formation; (4) bearing capacity - the possibility of the mine spoil, a mixture of soil and rock left over from the mining operation, is not capable of supporting the weight of the landfill; and (5) material for clay liners - the difficulty in locating uniform deposits of low permeability material for construction of clay liners and caps. The Carbon Limestone Sanitary Landfill, owned by Browning-Ferris Industries of Ohio, Inc., is sited in a former limestone quarry having unique topographic and geologic features which were enhanced by engineering design including a groundwater control structure and liner and cap systems. The Ohio EPA issued a PTI a Solid Waste Disposal Facility because of the site-specific characteristics and design features.

1:45 SEASONAL SIGNIFICANCE OF THM PRECURSOR SOURCES IN A SHALLOW, EUTROPHIC LAKE. A.B. Martin and R.E. Carlson, Dept. of Biological Sciences, Kent State University, Kent, OH 44242.

Trihalomethanes (THMs) form when chlorine reacts with certain naturally occurring organic molecules (THM precursors) during the disinfection of drinking water. THMs are believed to have significant carcinogenic and mutagenic properties. The elucidation of precursor sources is important because source management may lower costs and increase effectiveness of in-plant treatments. This study investigated seasonal changes in the relative importance of several potential sources of THM precursors in a shallow, eutrophic lake. The precursor sources investigated were algae, macrophytes, autumn-shed leaves and the watershed. A budget for precursor loading from these sources was developed. The seasonal significance of these potential precursor sources will be discussed.

2:00 TOXIC SUBSTANCES IN RIVERS AND STREAMS. Suresh Reddy Karri and Yung-Tse Hung, Civil Engineering Dept., and Howard H. Lo, Dept. of Geological Sciences, Cleveland State University, Cleveland, OH 44115.

Many of the toxic substances entering the freshwater today are those which were present several decades ago, but others have become significant recently. The effects of toxicants in flowing waters are modified by unidirectional flow and dispersion. The chemical quality of the receiving water also affects toxicity. Biological factors also contribute to the ultimate effect of pollutants. The potential for accumulation of toxic substances within the tissues increases the significance of certain pollutants which may be present in water even though ambient concentrations are very low. The biota of flowing water may be restored, following catastrophic entry of pollutants, by drift from unaffected regions upstream. Potential toxic substances include inorganic poisons, organic poisons, heavy metals, pesticides and PCBs. Metals, pesticides and PCBs have the greatest potential for bioaccumulation. Few generalization can be made regarding the effects of toxic substances on the biota. Each species tends to respond to different toxicants in different ways and even at different stages in its life-history.

2:15 ASSESSING TOXICITY OF DRINKING WATER CONTAMINANTS. Ramesh V. Yalamanchi and Yung-Tse Hung, Civil Engineering Dept., and Howard H. Lo, Dept. of Geological Sciences, Cleveland State University, Cleveland, OH 44115.

Chemicals in drinking water can cause a variety of adverse health effects in human. A number of means are available to assess the toxicity of these chemicals. The most important means are epidemiology and animal tests. Epidemiology provides the most direct and least ambiguous information. It assesses the actual occurrence of toxic effects in human population exposed to chemical contaminants. But there are limitations to the use of epidemiology. Currently experimental testing on animals is the most important means available to determine the toxicity of chemicals. A major limitation of these tests is the uncertainty about their applicability to humans.

2:30 LEAD CONTAMINATION IN DRINKING WATER. Ramakrishna Kaza, Yung-Tse Hung and Nagaraju Sreeramulu, Civil Engineering Dept., Cleveland State University, Cleveland, OH 44115.

Lead is an important trace element because it is highly toxic to biological systems. Drinking water from tap may be a significant source of lead contamination, because of reaction of the water with lead pipe. The main source of lead is lead-tin solder from newly installed water pipes. Excessive lead levels in drinking water can be the result of corrosive water dissolving this metal from lead service pipes. Acute or chronic lead toxicity affects three systems of human health: neural, hematopoietic and renal. This paper covers the health effects due to the consumption of lead contaminated drinking water and its remedial measures to be implemented.

2:45 EFFECTS OF ACID RAIN ON SOIL. Jae-Choun You and Yung-Tse Hung, Civil Engineering Dept., Cleveland State University, Cleveland, OH 44115.

The main source of sulfur and nitrogen oxides is the combustion of fossil fuels. A substantial portion of the sulfur dioxide ( $\text{SO}_2$ ) is emitted in the highly industrialized area.  $\text{SO}_2$  and  $\text{NO}_x$  are oxidized in the atmosphere and, in the presence of moisture, convert to sulfuric acid and nitric acid. These two acids consist of acid rain. There are no evidence of widespread forest damage from current ambient level (pH 4.0-5.0) of acidic deposition in the United States. Long-term changes in the chemistry of some sensitive soils are expected, but it is uncertain whether this results in reduced forest health, how the effect would be manifested, or how long it would take for such an effect to occur. Virtually no damage to plants was evident at the end of the acid rain treatment. However,  $\text{H}^+$  and strong acid anions in precipitation that come from chemical reaction of  $\text{SO}_2$  and  $\text{NO}_x$  increase soil solution acidity and anion concentrations which in turn increase concentration. Low soil pH will significantly reduce the growth of plants.

3:00 CONTROL OF AIR POLLUTION FROM AUTOMOBILE EMISSIONS. Zheng-Qin Fu and Yung-Tse Hung, Civil Engineering Dept., Cleveland State University, Cleveland, OH 44115, and Ruth Yu-Li Yeh, Chemical Engineering Dept., Ming Hsin Engineering College, Hsinchu, Taiwan.

Automobiles are a major source of emissions of volatile organic compounds (VOCs),  $\text{NO}_x$  and CO to urban areas. They have been the target of increasingly stringent Federal regulations that significantly reduced the emissions of new automobiles relative to those of the uncontrolled automobiles of the 1960s. Unfortunately, population growth, increases in driving, and a relative increase in the percentage of older cars in the fleet partially have offset the effects of improved emission characteristics of new automobiles. Emissions of VOCs and  $\text{NO}_x$  (ozone precursors) from stationary sources, which in aggregate account for the majority of these emissions, have remained fairly constant over the past two decades. Thus, many urban areas remain out of compliance with air quality. Even with regulatory controls that are likely to be implemented in the near future, most of these areas are expected to remain in violation of air quality standards.

3:15 EMISSION CONTROL FROM HAZARDOUS WASTE INCINERATION. Ramakrishna Kaza and Yung-Tse Hung, Civil Engineering Dept., Cleveland State University, Cleveland, OH 44115.

Incineration, whether on land or at sea, is increasingly the preferred treatment option for hazardous wastes, particularly for organic liquids and sludges. Volume is effectively reduced and toxicity is destroyed, eliminating the possibility of problem resurfacing in the future. However, one major concern associated with hazardous waste incineration is the emission of air pollutants, which need to be controlled as per stringent regulations of government agencies. This paper presents some of the controlling technologies for incineration air pollution control, including wet scrubbers, dry scrubbers, and electrostatic precipitations.

3:30 BIOLOGICAL DEGRADATION OF PHENOLIC COMPOUNDS. Ganesh Balakrishna and Yung-Tse Hung, Civil Engineering Dept., Cleveland State University, Cleveland, OH 44115.

This paper discusses the biodegradation of various organic compounds by various types of bacteria. The organic waste from a paper mill contains the abiotic and the dehydroabiotic resin acids which are very toxic for the aquatic organisms. A large population of *Bacillus psychrophilus* was able to oxidize the DHA. Another study indicated that a mixed culture of microorganisms immobilized onto celite diatomaceous earth particles were used to degrade 3,4-dichloroaniline (34DCA) in a three phase draft tube fluidized bed bioreactor. Biodegradation was the dominant removal mechanism illustrated by the contaminant chloride ion evolution. These pollutants included aromatic compounds such as hexachlorobenzene and PCBs and also some aliphatic compounds like tetrachloroethylene and trichloroethylene. The dechlorination occurs under anaerobic conditions and results in less chlorinated aerobically degradable products. Engineering systems, or in situ bioremediation can effectively employ sequential anaerobic/aerobic microbial processes to biodegrade chlorinated organic compounds.

3:45 HETEROGENEOUS PHOTOCATALYSIS DEGRADATION OF CONTAMINANTS IN WATER. Majid Zarrinifar and Yung-Tse Hung, Civil Engineering Dept., Cleveland State University, Cleveland, OH 44115.

Heterogenous photocatalytic reactions of degradation of chlorinated biphenyls in presence of  $\text{TiO}_2$  and degradation of CC14, CFC13 and CF2C12 in presence of ZnO were reviewed. The

experiments were conducted in a circulating differential conversion quartz photoreactor and were catalyzed by the UV light of 300-400 nm. The slurry of 0.15% powder catalyst in water was continuously recirculating in the reactor during the experiment. The rate equation satisfies the Langmuirian surface in which the rate of reaction is determined from:  $(\text{rate})^{-1} = k_1 + k_2 (C)^{-1}$ .  $k_1$  and  $k_2$  are constants and  $C$  is the concentration of the reactant. The HCl and HBr, which are the products of the mineralization of the chlorinated hydrocarbons, are the reaction inhibitors. Therefore, the rate of reaction was changed to:  $(\text{rate})^{-1} = K_1(1+K_2(C)^{-1} + K_3K_4(C)^{-1})$ . Here  $C$  and  $C_i$  are the concentrations of the substrate and the inhibitor, while  $K_1$ ,  $K_2$ ,  $K_3$  and  $K_4$  are constants.

4:00 USE OF ELECTROKINETICS FOR HAZARDOUS WASTE SITE. Ramesh V. Yalamanchi and Yung-Tse Hung, Civil Engineering Dept., Cleveland State University, Cleveland, OH 44115, and Ruth Yu-Li Yeh, Chemical Engineering Dept., Ming Hsin Engineering College, Hsinchu, Taiwan.

The use of electrokinetics has found successful field application in reclamation of naturally contaminated soils. Treatment methods such as in situ bioremediation or in situ chemical treatment face a problem of moving nutrients and chemicals through soil to close proximity with the contaminants using hydraulic pressure. Electrokinetics is effective where these methods fail. Electrokinetics is the process in which direct current is placed across contaminated soil in order to enhance the migration of pollutants from the soil to the point of collection. Laboratory and field experiments in United Chrome Superfund site showed a removal of 95 percent of contaminants and Pb(II) at levels of 118 to 145 ug/g in dry kaolinite was efficiently removed by electrokinetic soil processing. The removed Pb(II) was mostly electroplated at the cathode. Although the result of various studies suggest that electrokinetics is a promising technology, further testing is needed at both the laboratory and field levels to fully develop this technology for site remediation.

4:15 BIOREMEDIATION METHOD FOR HAZARDOUS WASTE TREATMENT. Suresh Reddy Karri and Yung-Tse Hung, Civil Engineering Dept., Cleveland State University, Cleveland, OH 44115, and Ruth Yu-Li Yeh, Chemical Engineering Dept., Ming Hsin Engineering College, Hsinchu, Taiwan.

Bioremediation is a promising technology in waste site cleanup. The acceptance of bioremediation by industry in the U.S. has been due to its relatively low cost compared to incineration or safe land filling; its effectiveness in dealing with a wide variety of organic compounds; and its provision of a final, ecologically sound solution to toxic waste problems. When a compound is biodegradable, its degradation products are carbon dioxide, cell protein and water. The primary methods of biological treatment includes: bio-reactors, land farming, composting, and in situ bioremediation. Three general bioremediation techniques are in use today- biostimulation, bioslurry, and biofarming. Biostimulation is used primarily for cleanup of contaminated groundwater and soils. Bioslurry is used for sludges and highly contaminated soils. Biofarming is applied to lightly contaminated soils, usually less than 1% organics. Each of these is discussed in this paper, along with other aspects of the subject.

4:30 KINETICS OF BIODEGRADATION BY MICROORGANISMS ON SURFACES. Majid Zarinfar and Yung-Tse Hung, Civil Engineering Dept., Cleveland State University, Cleveland, OH 44115.

Over ninety percent of microorganism in aquatic system are found in or on pipes, aquatic plants and animals. Biofilm plays an important role in biodegradation of organic pollutants. Mass transport of substrate from bulk liquid to the surface of the biofilm is  $F = -D (dc/dZ)$ . Here  $D$  is the coefficient of molecular diffusion in the  $Z$  direction and equals to  $KE$ .  $E$  is the exchange constant across a layer of  $Z$  thickness and has the dimensions of velocity,  $K$  is the reciprocal of resistance across the layer and  $F$  is the flux of substrate across  $Z$ . In steady state the rate of substrate utilization is equal to the rate of substrate diffusion. There is a minimum of substrate concentration  $S_m$ , below which the entire biofilm is in net decay. The equation for minimum substrate concentration is  $S_m = K_s \cdot b / (Y \cdot K - b)$ .  $K_s$  is the Monod half-maximum rate concentration,  $b$  is specific biofilm loss coefficient,  $Y$  is the true yield bacterial mass per unit of substrate utilized, and  $K$  is the maximum specific rate of substrate utilization by bacteria.

4:45 EFFECTS OF BACTERIAL CULTURE PRODUCTS ADDITION ON ACTIVATED SLUDGE TREATMENT OF POTATO WASTE WATERS. Howard H. Lo, Dept. of Geological Sciences and Yung-Tse Hung, Dept. of Civil Engineering, Cleveland State University, Cleveland, OH 44115.

A laboratory study was conducted to study the effects of bacterial culture products addition on the treatment of potato wastewaters. Parameters investigated include types of live liquid microorganisms (LLMO), aeration time, LLMO dosages, and wastewater strength. Types of LLMO include S-1, G-1, E-1, N-1, and NEW-1. Wastewater strength included 500, 1250, and 2000 mg/l TOC (total organic carbon), LLMO dosages used were 10, 105, and 200 mg/l. Synthetic potato wastewater was used as reactor feed. TOC and MLVSS (mixed liquor volatile suspended solids) were determined during the bench scale aerobic batch activated sludge

reactor study. Results showed that bioaugmentation with LLMO addition had an important effect in reducing the sludge production and increasing TOC removal efficiency for the activated sludge treatment of potato waste water. Two distinct phases, sludge production in the first six hours and sludge reduction beyond six hours of aeration time, were observed in this study. It was also noted that types of LLMO had an important effect on both TOC removal efficiency and sludge reduction. S-1 LLMO was the most effective, while N-1 or E-1 was the least effective LLMO in the treatment of potato wastewaters. The best TOC removal efficiency obtained was 98%, while the best sludge reduction obtained was 67% with respect to initial MLVSS concentration.

## AQUATIC & WETLANDS ECOLOGY

### 9:00 A.M., Saturday, May 1, 1993

### Cushwa Hall 2027

### James Amon, Presiding

9:00 A PRELIMINARY CLASSIFICATION OF OHIO WETLAND PLANT COMMUNITIES. Lonnie R. Young, Ralph J. Garono and James G. Kooser, Rettew Associates Inc., 5010 Ritter Rd. Ste 102, Mechanicsburg, PA 17055.

Vegetation classification allows researchers to catalog, inventory, compare, analyze and rank examples of the various plant communities. These classifications are generally developed for a single, specific purpose. The most comprehensive classification of Ohio's vegetation was developed by Anderson (1982) for the Ohio Natural Heritage Program. Its purpose was to provide a framework for inventorying, cataloging, and analyzing potential natural areas. As such, communities of less than potential natural area quality are frequently hard to classify using this system. Therefore, such a classification may have limited use in a wetland regulatory program. Anderson recognized twelve major groups of plant communities containing forty-five recognizable community types, at least 37 of these are wetlands. The community types were developed based largely on qualitative data; ordinations were not performed due to both a lack of quantitative data, and the time required to gather such data. During the past five years, the Ohio Department of Natural Resources and others have compiled both presence/absence (120 wetlands) and quantitative data (50 wetlands) from a number of Ohio wetlands. We subjected these data to Detrended Correspondence Analysis (DCA) in an attempt to first validate Anderson's classification, then to determine whether it could be broadened to capture all wetland types in the state.

9:15 ORDINATION OF WETLAND INSECT POPULATIONS: CONTINUED EVALUATION OF A POTENTIAL MITIGATION MONITORING TOOL. James G. Kooser and Ralph J. Garono, Rettew Associates Inc., 5010 Ritter Rd. Ste 102, Mechanicsburg, PA 17055.

Success of compensatory wetland mitigation is usually judged by the number or percentage of plants which survive after planting, or estimates of percent cover. Counting surviving plants or measuring percent cover ignores several important wetland functions. Using new and previously published data, we examined the potential of monitoring replacement wetland functions using organisms not introduced into the mitigation area by wetland designers. Trichopterans were collected using paired light traps, and identified to genus. Presence/absence and abundance data from 29 Ohio wetlands were analyzed using Detrended Correspondence Analysis (DCA). DCA showed Trichopteran populations differed between wetland plant community types. Collections from wetlands had Trichopteran populations which differed from adjacent uplands. Wetlands sampled repeatedly over several years had stable Trichopteran populations. Recently constructed replacement wetlands appeared to have Trichopteran populations different from natural wetlands with similar vegetation. Though the time required to establish stable Trichopteran populations is not known, it may be possible to identify target populations of Trichopterans by which mitigation success may be judged. The presence of appropriate Trichopteran populations is evidence that the functions upon which the Trichopterans depend are operating in the mitigation area.

9:30 EFFECTS OF PHOSPHATE ON BACTERIOPLANKTON GROWTH IN OLD WOMAN CREEK-N.E.R.R. WETLAND. Courtenay Willis and R.T. Heath, Dept. Biol. Sci. and Water Resources Res. Inst., Kent State University, Kent, OH 44242-0001.

The purpose of this study was to determine whether bacterioplankton growth was limited by phosphate availability in OWC-NERR wetland, near Huron, OH. Samples were collected from open water regions of the wetland, filtered through 1.0  $\mu$ m filters to remove bactivores, and placed into flasks amended with  $KH_2PO_4$  to increase the concentration by 0, 200, or 400 nM. Growth was measured by increased bacterial numbers (acridlavine direct counts) and by rate of incorporation of  $^3H$ -thymidine into nucleic acids and protein. Flasks were incubated in the dark at ambient temperature (24° C) for 48 hours. Phosphate additions stimulated increase in bacterial numbers ( $13 \times 10^6$ /mL in the control to  $29 \times 10^6$ /mL in flasks amended with 400 nM phosphate). Phosphate amendments stimulated both rate of incorporation of  $^3H$ -thymidine into nucleic acids and the percent of cpm incorporated in nucleic acids. We conclude that



bacterioplankton growth in OWC-NERR was limited by phosphate availability. This work was supported by Ohio Sea Grant College Program.

9:45 LARCH DECLINE AT CRANBERRY SWAMP, A HIGH ELEVATION PEATLAND OF WESTERN MARYLAND. Donald R. Bailey and Brian C. McCarthy, Dept. of Environmental and Plant Biology, Ohio University, Athens, OH 45701-2979.

*Larix laricina* (eastern larch) is a boreal species with several small disjunct populations scattered throughout New York, Pennsylvania, Ohio, and Maryland. The two southernmost populations of the species can be found at Cranesville and Cranberry Swamps in western Maryland. Observations have suggested that, like many other conifers in the Appalachians, larch is declining at Cranberry Swamp. We undertook a study to assess the current and past structure of this population. Six 50 x 100m plots were placed throughout the swamp. We recorded all larches present, measured diameter at breast height (DPH), determined age via an increment core, and assessed health and vigor via several categorical variables. The population was found to be even-aged, with few to no seedlings or saplings, and in poor health. A dendrochronological analysis of the remaining healthy, living trees revealed that tree growth patterns fluctuated considerably over the past two centuries—but, no consistent pattern of steady decline was detected. The lack of regeneration prompted us to conduct a series of field and greenhouse experiments on seed germination and seedling growth and survival. Seeds from Cranberry Swamp exhibited only 11% germination under growth chamber conditions. Seedling growth, more so than survival, was found to be markedly affected by light and water regime in greenhouse and field experiments. Changes in hydrology associated with a road placed through the swamp may be responsible for the decline of larch. Shrub cover has increased dramatically and has altered the microenvironment necessary for larch regeneration. Mitigation may be necessary for preservation.

10:00 THE EFFECT OF SALINITY AND WATERLOGGING ON THE GROWTH AND SURVIVAL OF SALICORNIA EUROPAEA. Carolyn Howes Keiffer, Brian C. McCarthy, and Irwin A. Ungar, Dept. of Environmental & Plant Biology, Ohio University, Athens, OH 45701.

*Salicornia europaea* seedlings were exposed to various salinity and soil moisture levels for 11 weeks under controlled growth chamber conditions. Growth data including the height, number of nodes and number of branches per plant were measured weekly. Growth and survival of plants grown with the addition of NaCl were significantly higher than the plants which were not given a salt treatment, although there were no significant growth differences between plants under different water level conditions within the salt treatment group. Plants which were grown without NaCl demonstrated significant differences in growth between the three water levels, with the greatest growth occurring in the low water treatment group. All plants given a salt treatment survived until the end of the experiment, but high mortality did occur among the plants in the no-salt treatment group. All plants grown under non-saline, waterlogged conditions were dead by week six. This indicates that *Salicornia*, which is typically found in high marsh or inland salt marsh situations, was subjected to the combined stress of freshwater and waterlogging under these conditions.

10:15 CAREX LOUISIANICA BAILEY EXTANT IN OHIO. James K. Bissell, The Cleveland Museum of Natural History, 1 Wade Oval Dr., University Circle, Cleveland, OH 44106.

*Carex louisianica*, a clonal sedge, historically known in 1960 from one Ohio location in Richmond Township, Ashtabula County, was discovered on vernal pond flats within a swamp forest at Bradley Woods Reservation of Cleveland Metroparks in western Cuyahoga County. The new occurrence was found on October 8, 1992 upon the level topography of Maumee III Lake Plain. The new population is located 75 miles west of the historical occurrence. *Carex louisianica* was formerly listed as Extirpated by the Ohio Natural Heritage Program prior to the Bradley Woods discovery. Both the historical and new population in Ohio are northern disjunct populations within swamp forests on the southeastern U.S. Coastal Plain from southern New Jersey to Florida, west to Texas and north to Kentucky and southern Indiana.

10:30 SEASONAL MOVEMENTS AND HABITAT USE OF THE SPOTTED TURTLE IN CLARK COUNTY, OHIO. Eric S. Monschein and Timothy L. Lewis, Biology Dept., Wittenberg University, Springfield, OH 45501.

Ohio populations of spotted turtles (*Clemmys guttata*) appear to be declining, with previous studies implicating habitat destruction, predation, and over-collecting as the primary causes. Geographic isolation and small population size would increase vulnerability to these mortality factors. We studied the seasonal movements and habitat use of 35 spotted turtles from March, 1991 to September, 1992 at Prairie Road Fen in Clark County, Ohio. We equipped 18 turtles with trailing radio transmitters and located them three times per week. The locations of the remaining 17 were recorded when encountered. Population size was estimated using mark and recapture techniques. Turtles began movements each spring from within an area of 0.25 ha, with half from the same hibernaculum. Maximum distance from wintering hibernaculum during the study was reached in April and ranged from 8.0 to 731.5 meters. Turtles returned from these movements prior to nesting in June. Population size was <60 individuals. Turtles were rarely

located in water, although typically <2m from a stream. Habitats used were not merely the typical fen habitats, but included dryer habitat types. The purpose for the prenesting migration is unclear, but possibly related to nutritional demands. Long seasonal movements increase the vulnerability of the species in small refuges like Prairie Road Fen.

10:45 CARBON SOURCES OF THE ALGA GONYOSTOMUM SEMEN IN AN ACID BOG LAKE. Ping Jiang and Robert T. Heath, Dept. Biol. Sci. and Water Resources Res. Inst., Kent State University, Kent, OH 44242-0001.

The purpose of this study was to test the hypothesis that *Gonyostomum semen* is mixotrophic: partially satisfying its C-demand by photosynthesis, as well as by heterotrophy and bacterivory. It was conducted in Triangle Lake, a small acid bog lake in Portage Co., OH that has a pH of 4.9 - 5.2, large amounts of dissolved organic carbon compounds, and large populations of bacteria. Rate of uptake of  $^{14}\text{C}$ -NaHCO<sub>3</sub> or  $^3\text{H}$ -glucose or  $^3\text{H}$ -Leucine was determined on freshly collected samples under different temperatures and light intensities. Following fixation, *Gonyostomum semen* was isolated by passing it through 74  $\mu\text{m}$  Nitex net and collecting it on 37  $\mu\text{m}$  net. Cells were also isolated by isopycnic sedimentation in a Percoll gradient. Bacterivory was followed by conducting feeding experiments with fluorescent labeled bacteria. Our results show that *Gonyostomum semen* is mixotrophic. It obtains most of its carbon by photosynthesis and a small amount by heterotrophy, but it is not bacterivorous.

## TERRESTRIAL ECOLOGY

1:30 PM., Saturday, May 1, 1993

Cushwa Hall 2027

John F. Wing and Irwin A. Ungar, Presiding

1:30 PROBABLE 10-YR. CYCLE IN THE BALD AND GOLDEN EAGLE POPULATIONS IN NORTH AMERICA, 1934-1990. John F. Wing, Roger J. Spence and Timothy L. Lewis, Wittenberg University, PO Box 720, Springfield, OH 45501.

Migration and overwintering counts of the bald eagle (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos*) were analyzed for evidence of cycles. Cross-correlations and contingency periodograms (Legendre et al, 1981) were applied to residuals after removal of trends. Primary eagle data sources were Heintzelman (1975), Spencer (1976), Stalmaster (1987), and Brett (1991). At Hawk Mtn., PA, a 57-yr. migration count yielded significant ( $p < .05$ ) yr. and 22-yr. cycles for the golden eagle, and a significant ( $p < .01$ ) 20-yr. cycle for the bald eagle. At Waggoner Gap, PA, combined eagle counts gave a significant ( $p < .05$ ) 10-yr. cycle. At Hawk Ridge, MN, the test gave a significant ( $p < .01$ ) 9-yr. cycle for the bald eagle and also for bald-golden combined. Bald eagles (and both combined) fluctuated in synchrony with snowshoe hare (*Lepus americanus*) counts in Wisconsin, Ontario and Alberta for the length of the common record (22 years). NWR winter census counts of bald eagles in TX, KS and MO showed 9-10 yr. cycles ( $10 < p < .01$ ); and the latter correlated significantly ( $p < .05$ ) with some prey indices. Analyses of comparable eagle data from mountain and Northwest coast states further support such a cycle.

1:45 PROBABLE 10-YR. CYCLE IN TOTAL AUTUMN RAPTOR COUNTS FOR THE EASTERN U.S. 1934-1990. John F. Wing, Scott R. Fuller, and Timothy L. Lewis, Wittenberg University, PO Box 720, Springfield, OH 45501.

Raptor migration counts are usable for estimating trends (Titus & Fuller, 1990); but here we suggest they also may be useful for detecting cycle. Total counts from eight major sites (Heintzelman, 1975; Brett, 1991) were analyzed using cross correlations and contingency periodograms (Legendre et al, 1981). Intercorrelations of counts gave  $r = .18$  to  $.86$  with over half significant at ( $p < .05$ ) or better. Intercorrelation of residuals gave lower coefficients; but both an analysis of these and visual inspection of them showed the sites were participating in a broad, regional cyclic pattern. Indeed, the periodogram test showed significant ( $p < .05$ ) 10-yr. and 20-yr. cycles for Hawk Mtn., PA; a significant ( $p < .05$ ) 9-yr. cycle for Waggoner Gap, PA; and a significant ( $p < .05$ ) 10-yr. cycle at Hawk Ridge, MN. All major sites showed peak counts at the turn of each decade and lows at mid-decade. In general, sites were in unison; however, Hawk Ridge, MN was about 2-yr. delayed relative to Appalachia. Total raptor counts showed the classic 10-yr. cycle, but individual species counts were irregular. Species most implicated in the 10-yr. cycle were eagles and boreal breeding hawks.

2:00 APPROXIMATE 10-YR. AND 2-YR. PERIODICITIES IN CERVIDAE POPULATIONS IN THE BOREAL AND TUNDRA OF NORTH AMERICA. John F. Wing, PO Box 720, Wittenberg University, Springfield, OH 45501.

Cervidae are generally considered to be non-cyclic or to show much longer-length cycles (e.g., Peterson et al, 1984) or irruptions. Data are presented here which suggest Cervidae are deeply implicated in 10-yr. and 20-yr. cycles under the "natural" conditions which prevailed before



habitat changes and predator reduction. An analysis of population residuals given here shows that early fur data on *Rangifer tarandus* yields a 10-11 yr. cycle; and even an analysis of the contemporary growth in the Alces alces population on Isle Royale is compatible with the hypothesis of a 10-yr. cycle. Rounds' (1977) study of both *A. alces* and *C. elaphus* probably fits the 10-yr. cycle (as does the Yellowstone population of *C. elaphus*). Even for *Odocoileus virginianus*, early population records from NY support the cycle and also more recent MI harvest data.

2:15 STRONG COINCIDENT CYCLING OF FAUNA IN SIBERIA AND CANADA AS RELATED TO CLIMATIC TELECONNECTIONS. John F. Wing, Wittenberg University, PO Box 720, Springfield, OH 45501.

Recent studies of variance spectra of gridded surface air temperature and pressure data have shown cycles of 11 and 22 years in "significant areas" of the northern hemisphere in both European Russia and Western Siberia in Euro-Asia and both northwestern and northeastern Canadian coasts in North America. In this paper we discuss the implications of this and other climate studies for faunal cycles in both continents. We present extensive data showing highly significant ( $0.05 < p < .001$ ) fluctuations of 10-12 years in both wild hares (*Leporidae*) and squirrels (*Sciuridae*). Hare cycles in Yakutia, Siberia, for example, are almost exactly coincident with cycles over much of central Canada. It is known that wild populations on both continents are especially sensitive to winter and spring temperatures; but here they also are shown to be affected by precipitation. Population peaks come about two years after precipitation highs. For example, Yakutia hare populations show significant lagged correlation with June rainfall in the immediate region, and this, in turn, is in phase with rainfall stations of the Siberian plateau and with the cyclic runoff of the Ob and Yenisei Rivers.

2:30 CARRYING RESPONSE AND SATIATION OF ANTS TO SEEDS AND INSECTS. Stephenie Y. Liu and E. Raymond Heithaus, PO Box 1744, Gambier, OH 43022.

In myrmecochory, ants disperse seeds of many understory plants. Previous research shows that ants satiate to these seeds—seed removal is reduced drastically after a colony takes a few dozen seeds. Satiation was not expected in this mutualistic system. Alternate hypotheses to explain satiation are: 1) ants cannot process more food, and 2) seeds contain inhibitory factors. In order to examine the basis for satiation, we compared the carrying response of *Aphaenogaster rudis* to seed and non-seed food items. Two species of seeds, *Sanguinaria canadensis* and *Asarum canadense*, and pieces of meal worm larvae were used. Forty-five ant colonies were tested by performing two-day removal experiments in which the effect of a food item given the previous day was measured against the removal rate of a food item on the second day. After an initial seed treatment, seed removal decreased by 89%, but mealworm removal increased by 19%. After an initial mealworm treatment, seed removal decreased by 97.5%, and mealworm removal also decreased by 77%. We conclude that neither hypothesis can be rejected; food saturation is a factor in seed carrying, but is not the sole explanation for satiation.

2:45 PRELIMINARY REPORT ON THE GROUND BEETLES (COLEOPTERA, CARABIDAE) OF STILLFORK SWAMP NATURE PRESERVE, CARROLL CO., OHIO. John D. Usis and David B. MacLean, Dept. of Biological Sciences, Youngstown State University, Youngstown, OH 44555-3601.

Over six thousand carabid beetles were sorted from light trap catches made during the years 1984, 1986, 1987, 1988, and also from barrier pit-fall traps located within the swamp in 1992. Ninety-five species representing 28 genera have been identified with an estimated 1,500 individuals yet to be sorted and identified. The species composition of the adult ground beetle community was dominated by *Stenolophus ochropus* Say (3200+) which accounted for over 50% of the numerical total, mostly attracted to light but also collected from pit-fall samples. *Agonum* and *Bembidion* were the two dominant genera for richness (15 and 11 species, respectively). Thirty-nine species were rare, having fewer than five individuals collected. Catches of pit-fall traps in the swamp oak forest floors revealed *Abbaeus hamiltoni* Horn (398), *A. permundus* Say (160), *Pterostichus stygicus* Say (142), and *P. iucubandus* Say (140) as the four most abundant species. Most of the beetles collected are characterized as hygrophilous. Comparison of light trap and pit-fall catches showed markedly different faunal assemblages and suggest that both methods should be used to survey the entire ground beetle community.

3:00 BREAK

Irwin A. Ungar, Presiding

3:15 PROXIMATE FACTORS INFLUENCING NATAL DISPERSAL IN *PEROMYSCUS LEUCOPUS*. Joseph J. Jacquot and Stephen H. Vessey, Dept. of Biological Sciences, Bowling Green State University, Bowling Green, OH 43403.

Although the ultimate causes of dispersal have received much attention in recent years, the proximal causes have received little attention. This two-year study examined proximal cues that

could influence natal dispersal in an unmanipulated natural population of the white-footed mouse (*P. leucopus*). The study was conducted in northwest Ohio in a two-hectare oak-hickory woodlot. We checked 90 nest boxes once weekly to mark litters before weaning and to monitor subsequent natal dispersal. We ran a 15 x 26 live trapping grid on two consecutive days biweekly to monitor the population. Seventy-five litters were marked in the two-year period. Males dispersed significantly further than females (Mann-Whitney U,  $n = 49$ ,  $p = 0.001$ ). Litter size was associated with a male's tendency to disperse (ANOVA,  $n = 22$ ,  $p = 0.0001$ ), but not a female's (ANOVA,  $n = 24$ ,  $p = 0.911$ ). Males from smaller litters were more philopatric than males from larger litters. The proportion of males in a litter was correlated with male dispersal tendency (ANOVA,  $n = 25$ ,  $p = 0.008$ ), but not female dispersal tendency (ANOVA,  $n = 25$ ,  $p = 0.301$ ). Males from male-biased litters were more philopatric than those from female-biased litters. Mother's parity significantly influenced the tendency to disperse. Individuals of both sexes from a female's third or higher litter were more philopatric than those from a first or second litter (ANOVA,  $n = 44$ ,  $p = 0.024$ ). We have shown that natal dispersal of male *P. leucopus* is influenced by three proximate factors: Litter size, proportion of males in the litter, and mother's parity. Only one of these, mother's parity, was found to influence the natal dispersal of females.

3:30 EFFECTS OF INTERCROPPING AND HARVEST PRACTICES ON SMALL MAMMAL POPULATION DYNAMICS IN SOYBEAN AGROECOSYSTEMS. Megan Casey, Kelley M. McMillen, Christopher K. Williams, and Valerie A. Witmer, Dept. of Zoology, Miami University, Oxford, OH 45056.

This study examined the effects of intercropping and harvesting on small mammal population dynamics in soybean agroecosystems. The study was conducted between 12 September and 20 November 1992, at the Ecology Research Center, Miami University, Oxford, Ohio. Two hundred and eighty-eight live traps were set in the following four treatments (three replicates each): Soybean monoculture, soybean-clover, soybean-buckwheat, and soybean-corn. Extensive trapping was conducted before and following harvesting (1,440 trap nights per treatment). *Peromyscus maniculatus* and *Mus musculus* were abundant both before and following harvesting, but varied according to treatment type. *Peromyscus* population densities were found to be twice as large in the soybean monoculture compared to intercropped treatments. In contrast, the largest *Mus* population densities resided in the soybean corn treatments. Following harvesting practices, both *Peromyscus* and *Mus* population densities immediately increased and then steadily declined. Differences in population densities of *Peromyscus* and *Mus* were attributed to intercropping (i.e., the habitat mosaic) and to harvesting (i.e., grain availability and reduction in cover). Each individual captured five or more times was examined regarding dispersal behavior. Two of 18 female and three of 12 male *Peromyscus* were found to disperse (i.e., to change treatments). Dispersal behavior was not affected by harvest practices.

3:45 THE EFFECTS OF SMALL CLEAR-CUTS ON THE FOREST INTERIOR BIRD COMMUNITY IN THE GREEN MOUNTAIN NATIONAL FOREST, VERMONT. Stephen S. Germaine, David E. Capen, and Stephen H. Vessey, Dept. of Biological Sciences, Bowling Green State University, Bowling Green, OH 43403.

We initiated a two-year study to examine the effects on forest interior birds of small openings located within large expanses of northern hardwoods forest. Bird censuses and habitat measurements were conducted in 19 clearings and 57 forest plots at four distances from clearings during June - August of 1991 and 1992. Species richness, relative abundance, and percent community similarity were compared among the five plot groupings. Of the 50 bird species detected during censusing, 35 (70%) were neotropical migrants. Richness did not differ among the five groups of plots; however, similarity of species composition was only 41.6% between cleared plots and plots furthest into forest cover. Overall bird species diversity increased with no decrease in abundance for most forest interior birds near clearings. Of four locally common avian species known to prey upon or parasitize songbird nests, none was found in higher frequencies in or near clearings. However, three neotropical migrant species, black-throated green warbler (*Dendroica virens*), ovenbird (*Seiurus aurocapillus*), and solitary vireo (*Vireo solitarius*), showed lower abundances in forest nearest clearings. Our results indicate that small groups of clear-cuts increase overall bird species diversity while not attracting predator or parasite species associated with larger forest-edge ecotones. The abundance of only three of the 35 (8.6%) neotropical migrant songbirds present in the study area decreased.

4:00 *APHAENOASTER RUDIS* RESPONSE TO OLEIC ACID AND AN EVALUATION OF SATIATION EFFECT ON SEED DISPERSAL. Steven D. Rice and E. Raymond Heithaus, PO Box 1286, Gambier, OH 43022.

Myrmecochory is a seed-dispersal mutualism between ants and plants species. The diglyceride, 1,2 diolein, and on seed appendages evoke the seed-carrying response. We tested the hypothesis that myrmecochory is related to ant corpse removal behavior through similarities of diolein to oleic acid, a fatty acid that induces corpse removal in *Solenopsis invicta*. We offered *Aphaenogaster* nests bits of filter paper treated with oleic acid, sugar water, or distilled water and found that both oleic acid and sugar treatments were carried toward the nest. The data did not support the premise that oleic acid stimulates corpse-carrying in *Aphaenogaster*. Secondly, we made a preliminary evaluation of the importance of satiation to seeds on plant dispersal.

Eighty-one ant nests were mapped in two sites. The average food retrieval distance was 0.991 m ( $n=172$ ). We compared the average number of seeds released by two plant species within a typical nest's foraging range to observed satiation levels to predict whether satiation would cause some of the available seeds to be ignored. At observed nest densities, the density of seed capsules would have to exceed two per m<sup>2</sup>. Such densities did not occur in mapped sites.

**4:15 EFFECTS OF AN INVASIVE EXOTIC WEED (*Alliaria petiolata*) ON THE UNDERSTORY DIVERSITY OF A FLOODPLAIN FOREST COMMUNITY.** Brian C. McCarthy and Mary Droege, Dept. of Environmental and Plant Biology, Ohio University, Athens, OH 45701-2979.

Garlic mustard (*Alliaria petiolata* [Bieb.] Cavara & Grande; Cruciferae) is an exotic, naturalized, biennial herb that aggressively invades moist forest communities of the midwest and northeastern United States. Observations suggest that this invasive species may be displacing native herbs, grasses, and tree seedlings (understory community). We designed a field experiment, in a heavily infected floodplain woods, to determine if garlic mustard was displacing the native understory, and if so, could the understory species be regenerated via garlic mustard removal. Nine paired plots (1m<sup>2</sup>) were established such that all garlic mustard was removed from one plot in each sample unit pair. The percent cover of all herbs graminoids, and woody seedlings was then monitored at monthly intervals through the field seasons of 1991 and 1992. Species diversity in experimental removal plots was evaluated relative to control plots. No significant ( $P > 0.05$ ) differences were observed in either species richness (S) or Shannon-Weiner (H') measures of diversity after one year. However, by the second year, diversity increased dramatically in the experimental removal plots ( $P < 0.001$ ). Species responses were individualistic, resulting in a variety of response patterns. Further, overall diversity appeared to be correlated to biomass of garlic mustard removed. This may simply reflect high vs. low-quality microenvironments. We conclude that garlic mustard is displacing native understory species and that its effects may be mitigated by selective weeding.

**4:30 SECONDARY SUCCESSION OF WOODY PLANTS ON BLENNERHASSETT ISLAND.** Nancy E. Dew and Irwin A. Ungar, Environmental and Plant Biology, Ohio University, Athens, OH 45701.

The purpose of this paper is to determine the difference in forest cover on Blennerhassett Island from 1939 to 1992, with emphasis on the past eighteen years. This five hundred-acre island in the Ohio River was used extensively for agriculture until the DuPont Chemical Company purchased it in 1966. Aerial photos were used to make maps of the island. Forest stands were sampled using the point-quarter method. Nested quadrats at each point allowed identification and counts of seedlings and saplings. Results show that considerably more of the island is forested today than in 1939. Species which have invaded open areas include *Acer saccharinum*, *Acer negundo*, *Asimina triloba*, *Ulmus americana*, and *Robinia pseudoacacia*. The major natural plant communities include *Acer saccharinum*, *Salix nigra*/*Acer saccharinum*, and *Acer negundo*/*Ulmus americana*. These cover about 50% of the island, while meadows and plantations of *Juglans nigra* and *Liriodendron tulipifera* cover the remainder. Only *Asimina triloba* and *Acer* spp. are represented in the seedling class, with *Acer negundo* most abundant.

## AQUATICS & AQUATIC TOXICOLOGY

**9:00 A.M., Saturday, May 1, 1993**

**Cushwa Hall 2028**

**Karl E. Havens, Presiding**

**9:00 AN INVESTIGATION OF HYPOGEAN MEIOFAUNA IN SEDIMENTS ADJACENT TO THE NORTH FORK LITTLE MIAMI RIVER, CLARK CO., OHIO.** David B. Rush and John B. Ritter, Box 3688, Wittenberg University, Springfield, OH 45501-6100.

The presence and distribution of hypogean meiofauna were investigated with respect to changes in hydrogeology and groundwater chemistry. Information about the local groundwater quality and meiofauna taxa has implications for establishing meiofauna as groundwater quality indicators. Samples were collected from a shallow, alluvial, sand/gravel aquifer overlain by fine-grained floodplain deposits. Depth to the water table varied from 65.6 cm in July to 122 cm in October. The number of organisms per sample ranged from zero to 1,470 individuals. Nematodes, Rotifers, and water mites were the most abundant groups collected making up 73, 171, and 2% respectively of the total organisms. Copepods represented .2% of the total organisms collected. The temporal distribution of organisms was dependent on water table depth; total number of individuals increased as the depth to the water table decreased. Uneven distribution of organisms at a specific sampled depth may be due to variations in levels of total dissolved solids, nitrates, and phosphates. Organism abundance tended to decrease with increased sample depth.

**9:15 MALATHION INDUCED CHANGES IN OVARY OF AN AIR-BREATHING FISH, *Heteropneustes fossilis*: A HISTOLOGICAL STUDY.** Hiran M. Dutta, Dept. of Biological Sciences, Kent State University, Kent, OH 44242. A. Nath, S. Adhikari, P.K. Roy, N.K. Singh, & J.S. Datta Munshi, Postgraduate, Dept. of Zoology, Bhagalpur University, Bhagalpur-812 007 India.

The ovary is a vital organ for the propagation of fish and, therefore, it was felt necessary to study the effects of an organophosphate malathion, on an air-breathing catfish, *Heteropneustes fossilis*. The study is particularly focused on microscopic changes that may occur on ovigerous lamellae, oocytes at different stages of development, and the nucleus of the immature oocyte. Change in the estrogen level in blood serum was also investigated. Clumping of the cytoplasm appears after 24 hrs. of exposure to malathion, which became intensified after 48 hrs. Degeneration in the follicular cells was also observed. 72-hr. exposure brought about an increase in the number of nucleoli, shrinkage of nuclear materials, adhesion of oocytes, etc. With 96 hrs. of exposure, nuclear materials of all oocytes shrink to a smaller clump. The oocytes are fused together and follicular epithelium becomes loose and ruptured. A few atretic oocytes are also visible. Radioimmunoassay of the estrogen level in blood serum after 72 hrs. of exposure of malathion reflected a reduction in the level. The combined histopathological and estrogen determination approaches of this study revealed that the histopathological condition of the gonad is reflected in malfunctioning of the endocrine system and hormonal disbalance.

**9:30 EFFECT OF ENDOD, A NATURAL MOLLUSCICIDE, ON THE ATTACHMENT OF ZEBRA MUSSELS.** Jerome Mezui, Harold H. Lee, University of Toledo, Biology Dept., 2801 W. Bancroft St., Toledo, OH 43606.

Endod, *Phytolacca dodecandra*, which has been used in East Africa for many years as soap, has been shown to possess molluscicide properties. Previous studies have found Endod to be lethal for zebra mussels (*Dreissena polymorpha*) at concentrations higher than 20.0 mg/L, while lower concentrations weaken and inhibit their attachment and aggregation. To study the mode of action, we investigated the effect of Endod on the strength of attachment of zebra mussels to the substratum by treating the animals at 5.0 mg/L, 10.0 mg/L and 20.0 mg/L of Endod for 4.0 hours, 8.0 hours and 20.0 hours. The strength of attachment was measured by allowing a mussel to attach on to a microslide and lifting the animal with a fork connected to counter weights. Weights were added until the animals were detached. The force needed for detachment was converted into Newtons. The experiment suggests that the Endod target site is not in the chemical structure of the threads themselves or the adhesion of the threads to the substratum. The target site is the byssal gland which synthesizes the byssal threads.

**9:45 THE EFFECTS OF TWO CHEMICAL STRESSORS ON THE FRESHWATER ZOOPLANKTON: A MESOCOSM STUDY.** Karl E. Havens, Dept. of Biological Sciences & Water Resources Research Institute, Kent State University, Kent, OH 44242.

Mesocosms in an alkaline Ohio lake were filled with lake water and resident plankton, and dosed with ten levels (0 to 200 µg liter<sup>-1</sup>) of copper (experiment 1) or carbaryl (experiment 2). Plankton responses were determined after four-day incubations. Population level responses differed for the two chemicals, but community responses were similar. Across the gradients of increasing chemical doses, cladocerans declined and copepods became dominant. The cladoceran declines may have secondarily affected food web function. In the Carbaryl experiments where the chemical did not directly affect algae, the algal biomass increased greatly over the range of dose levels. This was coincident with declining cladoceran biomass, and suggested a removal of top-down control.

**10:00 EFFECTS OF A CHEMICAL STRESSOR ON PELAGIC FOOD WEB FUNCTION.** Karl E. Havens, Dept. of Biological Sciences & Water Resources Research Institute, Kent State University, Kent, OH 44242.

Mesocosms in an alkaline Ohio lake were filled with lake water and resident plankton, and quadruplicates were either spiked with CuSO<sub>4</sub> (100 µg liter<sup>-1</sup>) or were untreated. Two mesocosms in each treatment were then inoculated with either <sup>14</sup>C glucose or <sup>14</sup>C bicarbonate, forms of C taken up by bacteria and algae, respectively. The fate of radiolabel was monitored for 14 days via size fractionation of the plankton and liquid scintillation counting to determine activities. Copper suppressed C flux to the >200 µm size fraction (the macrozooplankton), and this effect was most pronounced for the bacterial-based pathway. This reflected a loss of daphnids from the zooplankton, which became dominated by copepods. Copepods prey especially on large algae, and are not effective bacterial grazers. The results show that chemical stress can greatly alter the functioning of the pelagic community.

**10:15 THE EFFECTS OF DIET ON THE VALIDITY OF 7-D *Ceriodaphnia dubia* TOXICITY TESTS.** Blas Cerda and John Olive, Dept. of Biology, The University of Akron, Akron, OH 44325-3908.

The purpose of this study was to evaluate the effects of four diets on the frequency with which valid seven-day *Ceriodaphnia dubia* toxicity tests are obtained. Survival and reproduction were

used as indices to determine the efficiency of each diet in producing valid tests. Diet did not differentially affect the ability of *C. dubia* to meet the survival requirements, but it differentially affected the reproductive performance of these organisms. The diet based on *Selenastrum capricornutum* (alga) plus a Yeast-Cerophyll- Trout Food (YCTF) mixture produced valid tests with the highest frequency, followed by YCTF alone, then by *Chlamydomonas reinhardtii* (alga), and finally by *Selenastrum* alone. These differences were predominantly due to delays in reproduction caused by the inefficiency of the algal diets and YCTF alone to elicit fast development of neonates. The efficacy of a diet in frequently producing valid toxicity tests, therefore, must be considered when selecting a diet for use in these tests.

10:30 ZEBRA MUSSEL (*DREISSENA POLYMORPHA*) GRAZING ON PHYTOPLANKTON AND BACTERIOPLANKTON IN SAGINAW BAY. Soon-Jin Hwang and Robert T. Heath, Dept. of Biol. Sci. and Water Resources Res. Inst., Kent State University, Kent, OH 44242-0001.

Despite a great deal of economic and ecological attention, the feeding ecology of zebra mussel is not well understood. The purpose of this study was to test the hypothesis that zebra mussels may discriminate between algae and bacterial-sized particles in natural communities. We added 15 mussels to four L containers with freshly collected planktonic communities from mesotrophic and eutrophic regions of Saginaw Bay in July, August, and October, 1992. Zebra mussels preferentially graze diatoms, small nanoflagellates, and small chlorophytes. Most of the large chlorophytes, colonial blue-greens, and caryophytes with gelatinous layers were not effectively grazed. Zebra mussels did not significantly graze bacteria. Plankton community diversity and dominance indices were altered by zebra mussel grazing. Our study suggests that zebra mussel discriminates suspended particles not only by mechanical size selection. This study was supported by the National Sea Grant College Program/NOAA.

10:45 EFFECT OF ZEBRA MUSSELS (*DREISSENA POLYMORPHA*) ON BACTERIOPLANKTON PRODUCTIVITY IN SAGINAW BAY. R.T. Heath and S.J. Hwang, Dept. Biol. Sci. and Water Resources Res. Inst., Kent State University, Kent, OH 44242-0001.

This study examined the effects of zebra mussels on the growth of natural assemblages of bacterioplankton in Saginaw Bay. Zebra mussels were placed in bottles containing four L freshly collected unfiltered water from a eutrophic site (Sta. 5) and a mesotrophic site (Sta. 20); control bottles containing water but without mussels were run in tandem, incubated at ambient temperature and light conditions up to 48 hours. Rate of uptake of  $^3\text{H}$ -thymidine and  $^3\text{H}$ -leucine into protein and nucleic acids decreased by 60%-70% in Sta. 20 water but was unchanged in Sta. 5 water. Sta. 5 plankton was dominated by cyanophytes, only slightly grazed by zebra mussels; Sta. 20 was dominated by chlorophytes and diatoms grazed to numbers only 20% that of the control bottles. Filtered water from control bottles partially restored bacterial activity in bottles containing zebra mussels. These findings suggest that bacterioplankton depend on a constant release of labile DOC from phytoplankton, rapidly lost as algal cells are grazed. This study was supported by National Sea Grant College Program.

## PLANT & AQUATIC ECOLOGY

1:30 P.M., Saturday, May 1, 1993

Cushwa Hall 2028

Tim Wood and G. Dennis Cook, Presiding

1:30 POLLINATION ECOLOGY OF *PEDICULARIS PALUSTRIS* IN NORTH AMERICA. Lazarus Walter Macior, Dept. of Biology, The University of Akron, Akron, OH 44325.

The amph-Atlantic *Pedicularis palustris* (Scrophulariaceae) studied in freshwater marshes on Ile aux Grues in the Saint Lawrence River, Quebec, Canada, was pollinated by four bumble-bee species primarily by nototribic *Bombus borealis* queens foraging for nectar in the 11 mm-deep corolla tube and strobilic pollen-foraging *B. terricola* workers. Nectar-robbing *B. terricola* workers perforated the base of the corolla tube both dorsally and ventrally. Of 343 queens and workers of eight *Bombus* species in the area, *B. borealis* queens were among the longest-tongued (12.7 mm), while *B. terricola* workers were among the shortest-tongued (7.4 mm). Low (7%) fruiting under insect enclosures and abundant (97%) fruiting of open-pollinated flowers indicate insect pollinator dependence. Analysis of 139 corbicular pollen loads of *Pedicularis* pollinators included 88% of *B. borealis* queens with mixed loads and 91% of *B. terricola* workers with pure *Pedicularis* loads. This concurs with the generally greater pollen-foraging constancy of worker bumblebees. *B. terricola* was also the most abundant worker pollinator on *Hypericum perforatum* and *Vicia cracca* collecting mostly pure loads of *Hypericum* pollen and foreign or no loads on *Vicia*. Phenologically, *P. palustris* is a late spring queen/worker species. Concentration (13.9%) and composition (fructose+sucrose) of *P. palustris* nectar are comparable to those of other species. Like other *Pedicularis* species investigated, *P. palustris* is a root-hemiparasite.

1:45 COMPARISONS OF THE PHYSIOLOGY AND STRUCTURE OF DIFFERENT-SIZED YELLOW POPLAR (*Liriodendron tulipifera* L.). Amy L. Scherzer, USDA Forest Service, 359 Main Rd., Delaware, OH 43015.

Much of the data pertaining to the physiological responses of forest tree species to their changing environment have been obtained from seedlings. However, due to the many morphological and structure differences between seedlings and mature trees, it is not clear how this data can be used to interpret responses of trees in other stages of development. Instantaneous photosynthesis at saturating light and average leaf mass and area were measured on detached lower canopy leaves of different diameter (0.5 to 40 cm) yellow poplar, as well as from the lower, mid, and upper canopy within a select number of trees. Preliminary results indicated mid-July mean leaf mass and area significantly increased from the lower canopy to the upper canopy, although photosynthesis was not affected. These differences were not present earlier or later in the season. Comparisons of different-sized trees indicated mean leaf area and mass were greatest in seedlings, tending to decrease with an increase in tree diameter, but no differences in photosynthesis were detected. Findings indicate the need to consider canopy differences and seasonal differences in responses when extrapolating from seedlings to mature trees.

2:00 EFFECT OF STREAM ACIDITY ON DECOMPOSITION OF SUGAR MAPLE (*ACER SACCHARUM*) AND RED OAK (*QUERCUS RUBRA*) LEAVES. Carolyn J. McQuattie, Stephen L. Stephenson, and Pamela J. Edwards, USDA Forest Service, 359 Main Rd., Delaware, OH 43015.

The wide range in acidity levels in forest streams (e.g., due to differences in acid mine drainage or acidic deposition loads) may directly or indirectly affect leaf decomposition. A cytological study was undertaken to examine structural changes over time in leaves exposed to streams of different pH levels. Sugar maple and red oak leaves were collected at leaf fall, stored dry over the winter, cut into 1-inch<sup>2</sup> sections in the spring, and placed in mesh bags in one of two streams (pH 5.6 or 3.2). After 7, 14, 28, and 56 days, leaf squares were removed from each stream and prepared for light and electron microscopy. After seven days, alterations in cuticular wax structure were seen in both species at pH 3.2 but not at pH 5.6. After 28 days, sugar maple leaves from the pH 5.6 stream showed a loss of lower epidermal and spongy mesophyll cells that was not seen in red oak at pH 5.6 or in either species at pH 3.2. Dense phenolic-like compounds were seen in mesophyll cells of red oak but not sugar maple leaves at each harvest date. Overall, leaf decomposition was more rapid in both species at pH 5.6, probably due to increased numbers or types of aquatic microorganisms found at this pH. Acidity level appeared to have a direct effect on cuticular wax structure.

2:15 VERTICAL PHOSPHORUS TRANSPORT IN LAKES OF DIFFERENT MORPHOMETRY. Laura K. Mataraza and G. Dennis Cooke, Dept. of Biological Sciences and Water Resources Research Institute, Kent State University, Kent, OH 44242.

Phosphorus (P) inactivation is a lake management technique to control sediment phosphorus (P) release. Effectiveness is assessed by its ability to inhibit sediment P release and by whether it controls epilimnetic P, and thus algal blooms. Effectiveness in controlling Photic zone P in dimictic lakes depends upon the significance of vertical P entrainment. Vertical entrainment of hypolimnetic P is a function of basin morphometry and intensity of meteorological forcing. We report results from observations of vertical P entrainment during summer, 1992 wind events at three dimictic lakes, and one polymictic lake. These lakes represent a gradient of basin morphometry, as described by the Osgood Index (1988) and, therefore, differ in the significance of P entrained to the photic zone. P inactivation is most effective in polymictic lakes.

2:30 DYNAMICS OF NUTRIENTS, PHYTOPLANKTON, AND DISSOLVED OXYGEN IN LAKE HAMILTON. Scott C. Martin, Prakash B. Kotwal, and Bassel M. Abbas, Civil Engineering Dept., Youngstown State University, Youngstown, OH 44555.

Lake Hamilton, a reservoir near Youngstown, OH, serves as the water supply for Campbell, OH and several local industries. Anoxic conditions during mid-summer may result in poor water quality. To evaluate this problem, 25 sampling trips were conducted during 1987. Temperature, dissolved oxygen, transparency, chlorophyll *a*, nitrogen, and phosphorus were monitored weekly to biweekly. The average total phosphorus loading rate was estimated at 6.912 kg/d. The areal hypolimnetic oxygen depletion rate averaged 1.05 g/m<sup>2</sup>/d. Anoxia persisted for over four months at the sediment-water interface, and at times occupied the entire hypolimnion. Phytoplankton biomass and transparency varied dramatically; Secchi depth ranged from 0.7 m to 5.3 m. Based on several models of lake trophic status, Lake Hamilton can be classified as highly eutrophic. A modification of the USEPA's WASP4 eutrophication model was also calibrated for Lake Hamilton under 1987 conditions to identify and quantify the major interactions among nutrients, phytoplankton, and dissolved oxygen. Sediment oxygen demand was estimated at 2.66 g/m<sup>2</sup>/d, and accounted for much of the hypolimnetic oxygen depletion. Significant quantities of phosphorus (averaging 0.94 kg/d) were released from the bottom sediment during the anoxic period, resulting in hypolimnetic total phosphorus concentrations over 600 µg/L; however, much of this was returned to the bottom sediments via chemical precipitation after fall turnover.

2:45 BREAK

G. Dennis Cook, Presiding

3:00 COMPARISON OF THREE METHODS OF MEASURING WATER COLUMN PRIMARY PRODUCTIVITY IN OLD WOMAN CREEK ESTUARY. David V. Brewster and Brian C. Reeder, Dept. of Biological and Environmental Sciences, UPO Box 1250, Morehead State University, Morehead, KY 40351.

We examined water column production in a shallow plankton-dominated wetland adjacent to Lake Erie. From May through October, we estimated production using light-bottle/dark-bottle incubations, chlorophyll *a* concentrations, and whole system metabolism. Bottle incubation values and chlorophyll *a* values correlated well with each other; however production measured by diurnal oxygen changes was up to five times greater. We propose that whole system metabolism estimates are probably the best estimator of production because it takes into account not only planktonic production, but also epiphytic and benthic production. Further, because of the extensive resuspension and hypereutrophic status, we propose that inherent inaccuracies in the other two methods are intensified. For example, the bottles do not obtain the extra nutrients from resuspended sediments, and chlorophyll *a* values may be inaccurate because phytoplankton appear to increase chloroplast production in response to light limitations.

3:15 PHYTOPLANKTON-BACTERIOPLANKTON COUPLING IN SANDUSKY BAY. Rochelle Sturtevant, R.J. Garono, S.J. Hwang and R.T. Heath, Dept. Biol. Sci. and Water Resources Res. Inst., Kent State University, Kent, OH 44242-0001.

Coupling of phytoplankton and bacterioplankton metapopulations were evaluated by empirical comparison of chlorophyll *a* concentrations and acridine orange direct counts according to a method modified from Bird and Kalff (1984). Samples were taken along a transect running from sites at the mouth of the Sandusky River to the Sandusky Bay sub-basin of the central basin of Lake Erie during May-October of 1990 and 1991. Strong phytoplankton - bacterioplankton coupling is evidenced from the close relationship of the Sandusky Bay data to the regression analysis of Bird and Kalff. Storm water inputs progressing along the transect appeared to cause significant decoupling of phytoplankton and bacterioplankton metapopulations with coupling re-established within a short time after the storm water passed through the bay. This Study was supported by Ohio Sea Grant College Program/NOAA.

3:30 DETRENDED CORRESPONDENCE ANALYSIS OF PHYTOPLANKTON: ABUNDANCE AND DISTRIBUTION IN SANDUSKY BAY AND LAKE ERIE. Ralph J. Garono and Robert T. Heath, Dept. of Biol. Sci. and Water Resources Res. Inst., Kent State University, Kent, OH 44242-0001.

The purpose of this study was to identify factors correlated with patterns of phytoplankton distribution and abundance in Sandusky Bay and Lake Erie. Samples were taken from 11 sites along a 50 km transect extending from the lower reaches of the Sandusky River, through Sandusky Bay and into Lake Erie. Detrended correspondence analysis (DCA) ordinated sample sites along an axis that explained 76 percent of the variation in community composition; DCA axis I scores ranked in the sequence of Sandusky Bay < Lake Erie < Sandusky River. DCA axis I scores were strongly correlated with total P, soluble reactive P, algal phosphatase activity, dissolved oxygen, conductivity, turbidity, alkalinity, and bacterial numbers, but not chloride concentration. Sandusky Bay communities were distinct from those of near shore areas of Lake Erie. Our findings suggest that phytoplankton abundance and distribution is related to phosphorus availability, and that algal-bacterial interactions may be important in understanding distributional patterns of Sandusky Bay phytoplankton. This study was supported by Ohio Sea Grant College Program/NOM.

3:45 FRESHWATER DINOFLAGELLATES IN NORTHERN OHIO. Susan Carty, Dept. of Biology, Heidelberg College, 310 E. Market St., Tiffin, OH 44883.

Over 100 sites including ponds, lakes, and reservoirs in 21 counties in the northern half of Ohio were sampled during the summer of 1992. At least 15 taxa were identified, including 5 not previously reported. New taxa include *Ceratium brachyceros*, *Peridinium umbonatum*, *Cystodinedria inermis*, *Ceratium hirundinella f. silesiacum*, *f. robustum*, and *f. piburgense*. A list of dinoflagellates previously reported from Ohio is presented with nomenclatural updates and comments.

4:00 WESTERN LAKE CHUBSUCKER (*ERIMYZON SU CETTA KENNERLY*) POPULATION FOUND IN PORTIONS OF UNGLACIATED OHIO. Keith A. Searls and Paul M. Holeski, Dept. of Biology, University of Rio Grande, Rio Grande, OH 45674.

From April 1991 to November 1992, a survey to inventory the fishes of Symmes Creek, a stream that flows 243 miles through Jackson, Gallia and Lawrence Counties of Ohio, was initiated. The survey was made possible through a Cost Share agreement between the USDA Forest Service, Wayne National Forest and The University of Rio Grande. As a result, in the first year 44 species were identified including the finding of *Erimyzon su cetta kenne rly*, the Western Lake Chubsucker. Previously, this species had not been reported from unglaciated portions of Ohio except for questionable 1899, 1900 Lawrence and Belmont County records for which no specimens exist.

The first Western Lake Chubsucker was taken from Hewitt Run, a tributary of Symmes Creek above Lake Jackson. Initially, it was thought that the species may have been released into Lake Jackson as bait and had moved out into the stream. Subsequent collections were made at four other locations, however, including the headwaters of Symmes Creek, Blackfork, and Cambria Creek. Based on these findings, it is concluded that a native population of the species exists in the Symmes Creek watershed.

4:15 ADULT TRICHOPTERA OF THE DEVIL TRACK RIVER WATERSHED, COOK COUNTY, MINNESOTA AND THEIR ROLE IN BIOMONITORING. Bonnie K. MacLean and David B. MacLean, Biology Dept., Thiel College, Greenville PA 16125; Dept. of Biological Sciences, Youngstown State University, Youngstown, OH 44555.

Results of this study, based on data from 32 light trap collections of 7,912 adult Trichoptera made from 1990-1992, show that the Devil Track River Watershed in northeast Minnesota includes at least 16 families, 41 genera, and 103 species of caddisflies including five new state records: *Agrypnia colorata* Hagen, *A. deflata* (Milne), *Ceraclea angustus* (Banks), *Ceratopsyche recurvata* Banks, and *Platycentropus plectrus* Ross. The greatest number of species were represented by the families Limnephilidae (22), Leptoceridae (20), Hydroptilidae (13), Polycentropodidae (12), Hydropsychidae (11), and Phrygaenidae (10). Twenty two species were collected at all four sites and 46 at one or two sites. The greatest numbers of species were collected from Devil Track Lake (83) and Devil Track River (82) with fewer (64 & 41) from two sites on Junco Creek. Most species are widely distributed and inhabit cold streams and lakes throughout eastern and northern North America. The high species diversity at all sites, the low numbers of tolerant species indicated that water quality was good to excellent. However, increased water temperatures, acidity, or organic enrichment could adversely affect at least one third of the Trichoptera species inhabiting the Devil Track River Watershed.

## ARCHAEOLOGY, GEOGRAPHY, & REGIONAL DEVELOPMENT 9:00 A.M., Saturday, May 1, 1993 Cushwa Hall 2057 Alex Bobersky, Presiding

9:00 UBAID ARCHAEOLOGY AND CERAMIC DESIGN ANALYSIS. Barry E. Thompson, PO Box 1027, Dept. of Liberal Arts, University of Rio Grande, Rio Grande, OH 45674.

A critical survey of current Ubaid Period (sixth-fifth millennium B.C.) ceramic studies reveals both the limitations and tentat of ethnoarchaeological models in describing past cultures. Design element and motif analysis of Ubaid pottery from Southern Mesopotamia suggests that a methodology combining metric design measurements and qualitative painting style observations seems best suited to identify individual painting substyles. A discussion of potter's marks and the meaning of patterns of motif and form recognition and association indicates many current problems in design analysis based on sherd collections.

9:15 THE EBB AND FLOW UNDERGRADUATE STUDENT CHOICE FOR ACADEMIC MAJOR AMONG OHIO'S STATE-ASSISTED UNIVERSITIES, 1970-1990: GEOGRAPHY AND THE BIG PICTURE. Joseph G. Spinelli, Dept. of Geography, Bowling Green State University, Bowling Green, OH 43403.

In this paper, the author goes beyond last year's effort showing the re-ordering of Ohio's state assisted universities vis-a-vis their ranking of the percentage of undergraduate students who chose Geography over other social science disciplines. Here majors are agglomerated by fields and academic colleges to show the choice of major moving from traditional social science majors such as Geography and Political Science to "hot" fields in Business and to newcomers such as Computer Science only to be abandoned in a return to some of the traditionally-popular disciplines. In this fickle game, Geography demonstrates a resurgence among today's undergraduates. The data in this study come from the Ohio Board of Regent's annual "Student Inventory Data" series.

9:30 SUBURBAN GROWTH IN AKRON, OHIO. Leona M. Bowser, 1126 W. Exchange St., Akron, OH 44313.

Akron area suburbs have been growing since the early 1950's when Akron was a booming rubber town experiencing rapid growth. A new interstate highway system provided easy access to the outlying areas making them prime residential property. These factors contributed to the development of a ring of suburbs around the central city. As the area further developed during the 1970's, an outer ring of suburbs grew surrounding the earlier, inner ring. This paper will examine housing values in both the inner and outer ring of suburbs, and will dispel the myth that distance from or access to the CBD is the prime determinant of housing costs. Other factors such

as direction in relation to the CBD or regional ties to nodes of economic activity may have a greater influence on the cost of housing than previously thought.

9:45 FORECASTING THE IMPACT OF AN I-90 EXTENSION. Henry Moon, Dept. of Geography and Planning, The University of Toledo, 2801 W. Bancroft St., Toledo, OH 43606.

The purpose of this paper is to forecast the economic impact of a new highway segment across northern Ohio. The route in question would extend from Camp Perry in Ottawa County to the I-280/S.R. 795 intersection in Wood County. It is strongly recommended that the highway open as an extension of I-90. Currently, I-90 and I-80 transect northern Ohio as the Ohio Turnpike. With construction of this 20.625 mile freeway segment, Northwest Ohio could be better connected with the interstate highway system. Interstate highway impacts have proven to agglomerate around interchanges. By introducing key values into a step wise multivariate regression equation, the quantity and nature of the development expected to occur near the 4 proposed interstate highway interchanges is calculated. The following impacts are forecast: construction costs - \$122,887,190, spinoff construction costs - \$44,975,500, new full-time jobs 404, and their employment value - \$9,696,000. Using these estimates and relying on conservative construction and employment multipliers, 1.82 and 2.5 respectively, the project is forecast to have a value over \$500,000,000 dollars.

10:00 DISCUSSION BREAK

10:15 AN EXAMINATION OF REGIONAL DEVELOPMENT IN INDIA. Purba Banerjee/Bandyopadhyay, Dept. of Geography and Planning, The University of Toledo, 2801 W. Bancroft St., Toledo, OH 43606.

The objective of this paper is to analyze specific problems associated with regional development in India. The levels of development taking place in the country and relevant theories of development are considered. The methodology used involves close examination of the 1981 and 1991 Census of India. Results indicate that: there are regional developmental disparities, isolated pockets of squalor, a preponderance of tertiary activities, and development of a dual economy in different parts of the country. Based on close examination of census data, the following recommendations are suggested: a strong rural/agricultural base should be built with emphasis on agricultural marketing as well as cottage, handloom, and handicraft industries. More attention should be paid to small scale industries and business enterprises; grass-roots planning, and the hierarchy of growth foci.

10:30 RURAL NON-AGRICULTURAL ENTERPRISES: THEIR ROLE IN ECONOMIC DEVELOPMENT OF CHINA. Stephen S. Chang, Dept. of Geography, Bowling Green State University, Bowling Green, OH 43403.

Rural non-agricultural enterprises (industries and services) exist outside centralized state ownership and control and constitute the fastest growing sector of the Chinese economy in recent years. Deng Xiaoping's visit to southern China in January, 1992, and his pronouncements for rapid economic development, generated efforts to accelerate the establishment of rural non-agricultural enterprises by local officials. They represent a uniquely Chinese approach to economic development by establishing industrial and service enterprises in the rural areas. This approach may reduce further migration of people into the already overcrowded urban centers and improve the income of people in the rural areas. This paper will discuss the regions where rural non-agricultural enterprises are growing most rapidly and the reasons affecting their expansion. The economic, social and political impact resulting from their growth will also be explored.

10:45 THE U.S. GUANO ISLANDS OF THE PACIFIC: A BRIEF BACKGROUND. Thomas D. Anderson, Dept. of Geography, Bowling Green State University, Bowling Green, OH 43403.

In the 1840's, farmers in Europe and the United States began to become aware of the values of guano to enhance crop production. Within a decade British merchants established a monopoly trade with Peru, then the only known source. The high cost of the prized commodity spurred a search for alternative sources and in the United States led to the passage of the Guano Islands Act of 1856. This paper examines the background of that Congressional Measure, its basic provisions, and its application with a focus on the Pacific Ocean. The various islands claimed and the gradual relinquishment of most reflect changes in resource perceptions, agricultural technology, and geopolitical objective. These aspects are reviewed briefly and supplemented by a listing and map of the islands identified.

## GEOGRAPHY, LITERARY GEOGRAPHY, COMMUNICATIONS

1:30 P.M., Saturday, May 1, 1993

## Cushwa Hall 2057 Alex Bobersky, Presiding

1:30 IOWA: SEASONAL PERCEPTIONS THROUGH NATIVE POETRY. Theodore I. Erski and Ramesh C. Dhussa, Dept. of Geography, The University of Akron, Akron, OH 44325-5005.

This work explores a new dimension of literary geography, that offered by poetry. Perceptions of the four seasons have been evoked by employing the works of numerous Iowa poets. Geographers can benefit from such an analysis because it conveys the feelings and attitudes associated with the people of the state as interpreted by poets. More often than not, a "scientific analysis" is apt to miss this important aspect of landscape. Viewpoints of all four seasons have been represented in the native Iowa poetry. Spring poetry often conveys elated feelings, directly due to the warming days. Summer poetry reflects the peaceful, yet hard working attitude of the farmer. With the autumn colors in the trees, we learn how it feels to appreciate the fall season, and yet be saddened by it with the knowledge of the coming winter. The dark cold days conveyed in the winter poetry help in understanding the depression that frequently settles in during the cold months. Through this analysis we hope to better understanding the feelings and attitudes of Iowan's towards their shifting seasonal landscape.

1:45 THE HISTORICAL IMPORTANCE OF PHOTOGRAPHY IN CIRCUMARCTIC REGIONS. Rebecca A. Roethlisberger, Dept. of Geography and Water Resources Research Institute, Kent State University, Kent, OH 44242-0001.

Since the 1800s, photographs taken by explorers, hunters, traders, and later indigenous people of the Northern region, have molded "southern" perceptions of the circumarctic north. These photographs provide a permanent record for a culture that in the past has preserved its history orally. These photographs have also captured the impacts of rapid evolution in a previously subsistence society. This research examines the historic significance of arctic photography over the span of approximately 100 years. The examination begins in the 1860s with George Simpson McTavish, a Hudson's Bay Company trader and amateur photographer. Photographs from several expeditions of the late 1800s and early 1900s are highlighted to illustrate the encroachment of southern civilization into the arctic. The research concludes with the work of Peter Pitseolak, an Inuit who recorded daily village occurrences on film in the mid 1900s.

2:00 SPATIAL PATTERNS OF FM RADIO BROADCASTING IN THE UNITED STATES: 1937-1985. John S. Colburn, Kent State University Dept. of Geography, Kent, OH 44242.

The diffusion of innovations across the landscape is an important area of study to geographers. An innovation that has had a significant impact upon American society is commercial radio. Commercial radio has expanded, become more diverse, and maintained a high degree of competition with other media. Commercial FM radio has followed the same trends and, in recent years, has begun to amass more of the total radio market than AM radio. Because of the popularity of FM broadcasting, this study will examine the spatial distribution of FM radio broadcasting stations in the United States. A series of maps is generated for each decade of the time period and the diffusional process is identified as hierarchical diffusion with contributory elements of contagious diffusion occurring during the time period. The data suggest that adoption of the innovation is approaching the saturation point but is inconclusive as to whether or not saturation has occurred.

2:15 - 2:45 BUSINESS MEETING

2:45 - 3:15 THE STATUS OF THE OHIO GEOGRAPHICAL  
ALLIANCE

## SOCIAL & BEHAVIORAL SCIENCES

9:00 A.M., Saturday, May 1, 1993

## Cushwa Hall 2058 Robert Deitchman, Presiding

9:00 CONSUMER ADVOCATES AND RESEARCH BOARDS. Robert Deitchman, School of Social Work, The University of Akron, Akron, OH 44325-8001.

The service delivery system for people with disabilities has gone through many changes over the last several decades. The primary focus of researchers, planners, consumers and family members is the enhancement of community membership and an improved quality of life. The passage of the Americans with Disabilities Act has increased the level of self advocacy that consumers of service are exhibiting themselves. People with disabilities are not only being asked,



they are demanding to serve on research boards and advisory groups. The concentration of this presentation will be on a description of the various levels of potential involvement as well as an assessment of the interactive impact on researchers, planners, research and planning.

9:15 PEDIATRIC ONCOLOGY AND ASSESSMENT OF FAMILY NEED. Glenn A. Shields, D.S.W. and Connie Schondel, Dept. of Social Work, 413 South Hall, Bowling Green State University, Bowling Green, OH 43403.

Seventy-seven families who have, or had, a child diagnosed with cancer at the Medical College of Ohio were surveyed to determine their psychosocial need related to cancer. *The Family Needs Assessment* instrument was used to examine the following areas of need: general information, family and social support, financial, explaining to others, professional support, community services, child care, and health issues. The sample included 22 families who had a child recently diagnosed, 16 families who had a child on treatment for more than one year, 35 families who had a child in remission, and four families who had a child that had died from cancer. Data showed families in the newly diagnosed group to have expressed the greatest amount of need in each area. Overall, results indicated a strong need to communicate, receive and share information, and need for a strong, informal network of family and friends. Results have implications for future programming to meet unmet needs of families who have a child with cancer throughout the continuum of care.

9:30 EVIDENCE FOR SPONTANEOUS SOCIAL INFERENCE IN AN IMPLICIT MEMORY TASK. Kristina Wassmann-Mason, John Skowronski and Donal Carlston, The Ohio State University at Newark, University Dr., Newark, OH 43055-1797.

A continuing debate exists in the social psychology literature concerning whether people make spontaneous inferences about others in the course of observing the others' behaviors. Previous research has suggested that a trait may become activated in the course of encoding a behavior, but whether the trait is associated with the actor is empirically unclear. We developed a paradigm to assess this person-trait linkage. Subjects were first exposed to photo-behavior pairs in which they were given an opportunity to spontaneously draw an inference about the person in the photo from the behavior description. Later in the experiment, subjects were asked to learn photo-trait word pairs, and some of the pairs were conceptually equivalent to the photo-behavior pairs encountered earlier. Results indicated that these 'conceptually-equivalent' pairs produced better performance than new trait-photo pairings in a subsequent cued recall task, and further, that this enhanced performance cannot be explained by subjects' ability to recall the behaviors, which was assessed at the end of the study. The heightened ability to learn photo trait pairings even when subjects cannot remember the correct behavior performed by the person, suggests that a person-trait link was formed at behavior encoding.

9:45 THE FACTOR STRUCTURE OF LOVE IS CONSTANT INTO MIDDLE-AGE. Robin Butler and John Skowronski, The Ohio State University at Newark, University Dr., Newark, OH 43055-1797.

One of the possible limitations to recent research on the nature of love is that it has focused largely on traditional college students. Recent research (Butler & Skowronski, 1992) has revealed that there may be age-related differences in scores on scales designed to assess love styles (i.e., Hendrick and Hendrick's 1986 Love Attitudes Scale). These differences could indicate either that the factor structure of love is the same for middle-aged and younger subjects, but that their relative position on those factors varies, or that the factor structure of love is different for middle aged and younger adults. Separate factor analyses of middle-aged and younger subjects' responses to the Love Attitudes Scale revealed a similarity of factor structure across age groups. These results suggest that the differences that we obtained previously were due to age related differences in subjects' relative position on some of the love factors, not to age-related differences in the factor structure yielded by the Love Attitudes Scale.

10:00 IMPRESSION FORMATION AND BEHAVIOR MEMORY IN DEPRESSED AND NON-DEPRESSED SUBJECTS. Michelle Monroe and John Skowronski, The Ohio State University at Newark, University Dr., Newark, OH 43055-1797.

A study was conducted to replicate the finding that depressed subjects were more prone to recency effects in impression formation than non-depressed subjects, and to assess possible processing mechanisms that are responsible for this effect. Depressed and non-depressed subjects were asked to form and report impressions of either the intelligence/stupidity or the honesty/dishonesty of a number of social targets described by from one to four behaviors. After a filler task, subjects were then given a surprise recall task in which subjects were asked to recall as many of the behaviors as possible. Subjects' impression responses were examined for evidence of recency effects, and recall protocols were examined to see if depressed subjects showed enhanced evidence of incongruity effects in recall. Results are interpreted in terms of Waary and Gleicher's idea that depressed people might be less confident in their social judgments than non-depressed people, and hence, be more receptive to expectancy-inconsistent information.

10:15 SELF-PERCEPTIONS OF THE SOURCES OF SELF KNOWLEDGE. Laura Shannon, John Skowronski and Constantine Sedikides, The Ohio State University at Newark, University Dr., Newark, OH 43055-1797.

Three studies explored the sources of information that people use to acquire self-knowledge. Study 1 asked subjects to list all of the important sources of self knowledge that came to mind. A content analysis of these responses yielded 11 separate source categories, but more generally indicated that subjects acquire self-knowledge: (a) by way of self-reflective processes (e.g., thinking about the past, thinking about the future, self-inferential processes); and (b) as a result of the impact of social processes (e.g., social comparison and reflected appraisal mechanisms). Studies 2 and 3 examined the relative perceived importance of these informational sources via rankings and ratings, respectively. These studies indicated that although the opinions of others (social factors) do have an impact on the self, what people think about themselves (self-reflective processes) are perceived to be more important to the development of self-knowledge.

10:30 SELF-CENTRAL TRAITS AND THEIR IMPACT ON IMPRESSION FORMATION. W. Richard Walker, John Skowronski and Constantine Sedikides, The Ohio State University at Newark, University Dr., Newark, OH 43055-1797.

A pretest was used to identify whether the traits of honesty and intelligence were either central or not central to subjects' self-conceptions. In a subsequent impression formation task, social targets were described by behaviors relevant to either honesty/dishonesty, or to intelligence/stupidity. Subjects for whom the trait of honesty was central were more influenced by dishonest behaviors than subjects for whom the trait of honesty was less central; subjects for whom the trait of intelligence was central were less influenced by unintelligent behaviors than subjects for whom the trait of intelligence was less central. Hence, honesty-central subjects evinced enhanced negativity effects in judgment, while intelligence-central subjects evinced enhanced positivity effects. However, these effects emerged only when the target was described by multiple contradictory behaviors, not when the target was described by internally consistent behavior sets. This result suggests that trait centrality affects the weight given to particular behaviors in the process of impression formation, and not to pre-existing differences in perceptions of the behaviors themselves.

10:45 THE EFFECT OF THREAT ON MALE UPLIFTS: A GULF WAR CASE STUDY. Kathy D. Stubbs, Sara L. Staats, and Christie I. Parto, The Ohio State University at Newark, 1179 University Dr., Newark, OH 43055.

This research takes advantage of a naturally occurring threat, the Gulf War and the ground invasion of Kuwait, to study the effect of war threat on self-reported uplifts and hassles in family groups composed of college students, their mothers, and fathers. Twenty-three items from the Delongis, et al. (1982) Hassles and Uplifts Scale as well as other scales were administered to family groups the weekend of the ground invasion. Gulf War responses were compared to Non Gulf data collected from similar family groups in the summer of 1991, a period of no war threat. Because the Hassles and Uplifts Scale is most frequently used as a measure of stress, we expected an increase in Hassles score in the Gulf Group. This did not occur. However, significant difference in Total Uplifts were obtained. Based on a Factor Analysis, separate Uplift scales were constructed in order to consider specific Uplift domains. Fathers, but not mothers in the Gulf Group experienced significant Uplift increases relating to relationships with family, friends, their own health, and 'maintenance' items including cooking and housework. Caveats regarding the limitations of case studies are noted.

## SOCIAL & BEHAVIORAL SCIENCES

1:30 P.M., Saturday, May 1, 1993

Cushwa Hall 2058

Ralph Darr, Presiding

1:30 LEADERSHIP, FACULTY, AND DECENTRALIZED AUTHORITY. Dianne Brown-Wright, Isadore Newman and Larry Bradley, Zook Hall 301C, The University of Akron, Akron, OH 44325.

The literature defines leaders as individuals who possess power to influence others. Such power comes in five forms. Leaders can influence others through the positions they hold (legitimate power), through the ability to provide rewards (reward power), through their knowledge or technical expertise (expert power), through their ability to punish (coercive power), or through their personalities, i.e., the extent to which others identify with and like them (referent power). Research suggests that "referent" power leads to greater satisfaction and performance of followers as well as to increased organizational effectiveness. Such referent power can ensure as a result of such strategies as empowering others. Decentralized authority is a form of empowerment. More specifically, decentralization is described in the literature as a motivator for increased productivity as well increased self-efficacy. The purpose of this paper is to answer the following questions: 1. What is the relationship between leadership style and faculty attitudes,



productivity, and satisfaction?; 2. Do preferred leadership styles differ cross-culturally among faculty members?; 3. What is the relationship between leadership style and faculty internal/external locus of control?; 4. What are faculty attitudes specifically toward selected aspects of the concept of decentralization?; and 5. What are the prospects for an empowerment leadership model for faculty?

1:45 USING SATELLITE TECHNOLOGY TO MANAGE SELF-MANAGED EMPLOYEES. Theodore C. Alex and Joseph T. Martelli, University of Findlay, 1000 N. Main St., Findlay, OH 45840.

In a variety of organizations, many jobs are self-managed and performed off-site. Managing these activities is difficult or impossible. Resulting problems include: inefficiency, higher costs, poor or inconsistent service and quality. An example of this is the Truckload (TL) Motor Carrier industry, where each driver and truck is an independently operated production unit. Several TL firms have responded to these problems by utilizing satellite technology for monitoring and managing driver activities and performance, as well as for two-way communication. A recent survey of TL industry experience with satellite technology indicated positive results including: increased efficiency, more effective managerial control lower costs, and quality of service improvements. Negative factors included: loss of individuality, employee recruitment and retention problems, and concerns about "Big Brother". Areas of future research include: new areas of application, sociological and ethical impacts, and managerial paradigm shifts.

2:00 MANAGEMENT TIPS FOR SELF-IMPROVEMENT. William A. Durst, Civil Engineering Dept., Youngstown State University, 410 Wick Ave., Youngstown, OH 44555.

This paper discusses some basic ideas and suggestions for the improvement of management performance. The particular concern is in the field of construction management. However, these tips can be used in any managerial concern. Defining management, a manager and their related goals and objectives is the first topic covered. Next, the emphasis is placed on planning the project. Here, ideas on establishing specific goals and ways of achieving them are covered. Also, the use of schedules, considering the impact of one's plans on others and reviewing the overall picture are described. How to organize a team is described next. In this area the staffing and assignment of jobs along with linking of similar tasks and the synergy of a group are discussed. Now directing the work is covered. Here motivation of personal, delegation of authority but not responsibility, providing adequate resources and performance evaluations are spoken about. The approach to management called Total Quality Management is the next topic. The reemphasis of important ideas comes next, followed by some final conclusions.

2:15 METROPOLITAN LEADERSHIP: DAYTON, OHIO COMPARED TO FT. WORTH, TEXAS. Thomas Koebernick, Dept. Sociology, Wright State University, Dayton, OH 45435.

This study examines the characteristics of leaders in two distinct metropolitan communities. There are three broad objectives: a) to define the concept, metropolitan leadership, b) to determine the qualities and circumstances necessary for such leadership, and c) to identify the leadership structure of each community. In-depth interviews with 27 recognized leaders and responses to a questionnaire mailed to 100 additional leaders in each community provide the data. Ninety-six usable questionnaires yielded a response rate of 48%. Using the Chi Square test ( $p > .05$ ), significant differences for the two leader sub-samples are found. Five items dealing with assessment of the current leadership situation and three measuring the power resources needed to become a metropolitan leader are significant. Confidence in existing leadership is much lower in metropolitan Dayton and the need for personal influence in addition to important authority positions is much greater. We conclude that metropolitan communities will vary in leadership effectiveness and in their leadership process. We argue that the importance of locality variables for understanding metropolitan leadership is consistent with defining leadership as a power strategy involving influence and authority.

2:30 CORRELATIONS AMONG MEASURES OF ETHNIC GROUP IDENTITY. David Yonas, Naoko Oyabu-Mathis, and T. Neal Garland, Summit Counseling Center, Commonwealth Square, 300 N. Cleveland-Massillon Rd. Ste 14, Akron, OH 44333.

Membership in a particular ethnic group often has been cited as an important component of individuals' personal identity in a heterogeneous society such as the United States. However, empirical measurement of the strength of ethnic group identity has been a difficult task for social scientists. This paper reports the results of a search for correlations among 19 variables which relevant literature suggests should be related to the strength of individuals' ethnic group identity. Eight of the variables (feeling it is important to teach one's children about their ethnic heritage, knowing why one's family migrated to the U.S., wishing to visit one's country of origin, having spoken a language other than English in the parental home, having experienced discrimination because of one's ethnic membership, participating in ethnic cultural events, wanting to teach ethnic values to one's children, and participating in ethnic rituals) were correlated with strength of ethnic identity at the .05 or stronger level.

2:45 COLLEGE STUDENTS' CONTACT WITH THE ELDERLY IN JAPAN AND THE UNITED STATES. T. Neal Garland, Naoko Oyabu-Mathis, and Daizo Egashira, Dept. of Sociology, University of Akron, Akron, OH 44325.

Japan is generally regarded as a society in which the elderly hold high status, while the United States is seen as placing a high value on youthfulness and as relegating the elderly to a low status. This paper reports a comparison of the amount and types of contact which samples of college students in the United States and Japan have had with elderly persons and of how this contact is related to attitudes toward the elderly. Independent variables included interpersonal relationships with elderly persons, types of contacts with the elderly, degree of similarity of values and goals between older and younger generations, and experience living with elderly persons. Attitudes toward the elderly were generally positive in both countries, but some differences were found in the effects of the independent variables upon these attitudes.

3:00 RELIGIOUSITY AND CRIME RATES IN JAPAN AND THE UNITED STATES. T. Neal Garland, Dept. of Sociology, University of Akron, Akron, OH 44325.

Religious belief systems typically include numerous prescriptions and proscriptions which are expected to serve as guidelines in the lives of their adherents. However, the extent to which these guidelines actually are followed may vary tremendously from one belief system to another and from one adherent to another within the same belief system. A comparison between some broad measurements of religiousity and behavior in Japan and the United States provides a case in point. Approximately 95% of all Americans claim to believe in God or in a universal spirit of some kind, while the corresponding figure for Japan is 38%. About 47% of Americans claim that religion should be "very important" in everyday life, while only 5.7% of the Japanese make this claim. At the same time, crime rates in the United States are considerably higher than they are in Japan. Questions can be raised as to the extent to which religious beliefs truly guide behavior in the two countries. Non-religious cultural and social structural variables which may help to explain cross-cultural differences in crime rates are explored.

3:15 EFFECTS OF GENDER AND QUESTION PHRASING ON PERCEPTIONS OF THE NEEDY. W. Richard Walker, The Ohio State University at Newark, University Dr., Newark, OH 43055-1797.

Perceptions of needy persons might have either positive or negative connotations. The positive image might be of a person who is undeserving of hardship while the negative might be of a person who is deserving. One of two surveys were administered to subjects, one survey which asked positively phrased questions about the needy and one which asked negatively phrased questions about the needy. The surveys were identical except for phrasing. Subjects were asked 1) how much effort the needy put into improving their situations 2) how lazy the needy are 3) what percent of the needy would choose to work 4) what percent of the needy abuse welfare 5) what percent of the needy are alcoholics 6) what percent of the needy are mentally ill 7) what percent of the needy use illegal drugs. Subject gender was also treated as an independent variable in our analysis. The results indicate that gender had a significant effect on only one of our seven dependent measures. Phrasing had a significant effect on four of our seven dependent measures. Subjects in the positive Condition predicted higher percentages of alcoholics, mentally ill persons, and illegal drug usage in the needy population than did people in the negative condition. These findings may be explained in terms of attributional processes. People in the positive condition may have been trying to attribute the situation of the needy to external factors such as alcoholism, mental illness, or drug use.

3:30 THE CHILD BEHAVIORAL CHECK LIST AS A PREDICTOR OF SELECTED DSM III DIAGNOSES. Isadore Newman, Ronald F. Bobner, David O. Newman, Matthew L. Newman and Carole Newman, The University of Akron, College of Education, Akron, OH 44325.

Achenbach's Child Behavioral Check List (CBCL) is an instrument that is given to many thousands of children annually in school systems and mental health agencies. It is a standardized instrument with age norms for males and females, on which parents rate their child's behavior. The check list consists of nine behavioral scales, but for boys and girls ages 4-5, and girls 12-16 only eight scales are reported. The subjects for this study are 977 children who are clients of a large urban mental health agency, ranging in age from 4 - 16 years, representing a wide socioeconomic and ethnic range. The general research question was how well do the eight sub scales of the CBCL predict the most common DSM III diagnoses classifications such as, adjustment disorder, conduct disorder, attention deficit hyperactivity disorder and Global Assessment of Functioning (GAF)? Regression equations will be built to determine how well the sub scales can predict the DSM III classifications, along with cross-validation procedures to estimate the stability of the prediction function.

3:45 THE EFFECT OF RITALIN ON SHORT TERM MEMORY IN CHILDREN WITH ATTENTION DEFICIT DISORDER. Heather M. Tarczan, 26708 Jefferson Ct., Bay Village, OH 44140.

It is estimated that 5-10% of all school-aged children suffer from Attention Deficit Disorder (ADD),

a disorder of impulsive behavior, lack of concentration, and impaired memory function. Ritalin (methylphenyladate), a widely prescribed stimulant, is an aid used to improve attending skills, which are evidenced in both visual and auditory short-term memory as well as fine-motor tasks. Sixteen randomly selected Caucasian children, ages seven to sixteen, from the middle class suburbs of Cleveland were used in this study. The experimental population was composed of eight subjects who were diagnosed with ADD by a pediatric neurologist. The remaining eight subjects formed the control group which was matched to the experimental group according to age. Tests of auditory and visual short term memory were administered as were tests of hand-eye coordination. These "tests" were administered during two separate sessions; one when the experimental subject was on Ritalin, and one drug free. The experimenter was not aware of the drug status of the subject until after the conclusion of the second session. The results of this study contradicted with much current research. No significant improvements were found in the area of visual or auditory short term memory while the subject was on Ritalin. There was, however, definite improvement in the fine-motor coordination tasks while the subjects were on Ritalin.

4:00 INTERPRETING QUALITATIVE DATA: A METHODOLOGICAL INQUIRY. Isadore Newman and Suzanne MacDonald, University of Akron, College of Education, Zook Hall 301K, Akron, OH 44325-4208.

This study is a methodological inquiry into the interpretation of qualitative data. It explores a grounded theory approach to the synthesis of data, and examines the use of coding systems/units of analysis, building of categories, and development of themes. i.e., it focuses on ways of organizing data and attaching meaning, as research problems embedded in cultural context are explored. A qualitative research training task, with 3-5 member groups evaluating comic strip culture, is used. These questions are addressed: 1) What is the consistency between groups? 2) How do groups differ? 3) How do different ways of categorizing data lead to different interpretations of comic strip culture? 4) How does pre-existing knowledge of group members influence the development of categories and themes—their interpretations? Implications of the research center around 1) the idiosyncratic nature of qualitative research, and issues related to generalizability, 2) relations between questions/question types being asked and interpretations, based on the same data, and 3) relationships between the knowledge-base of researchers and the interpretation of data.

4:15 THE RELATIVE EFFECTS OF CMI AND NON-CMI PRACTICE QUIZZES UPON SUBSEQUENT TEST PERFORMANCE. Ralph F. Darr, Jr. and Gerald J. Blumenfeld, Zook Hall 301A, The University of Akron, Akron, OH 44325-4208.

The instructional effect of computer administered practice quizzes used in an educational measure course was assessed when the frequent revisions in the computer managed instruction program (CMI) created numerous operating problems which eventually required taking the program off line for sweeping revisions. The course was composed of three instructional modules. Each module contained eight to ten units. Under the CMI conditions, students took practice quizzes on computer terminals and received diagnostic and prescriptive feedback for each response to each item on the unit practice quizzes. Students were required to attempt all unit practice quizzes in a particular module before they were allowed to take the comprehensive module examination for a grade. Under non-CMI conditions, students were given one printed practice quiz per unit and provided appropriate feedback. Module examinations were administered on the same schedule and procedures under both conditions - i.e., two attempts at mastery on each module examination with item feedback provided to students who did not achieve mastery on their first attempt. Results were analyzed by considering both group means and also the number of students who did not pass module examinations on their first attempt. All comparisons were significant at or beyond the .05 level of significance. Data related to alternative explanations did not produce significant results.

**103rd Annual Meeting  
of The Ohio Academy of Science  
Will be hosted by  
The Medical College of Ohio  
at Toledo  
April 22, 23, 24, 1994**

# PLANNING FORM

8:00 A.M.

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11:15 -- All-Academy Lecture (Saturday, May 1st.)

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